1971

A Comparison of Crossed Dominant to Unilaterally Dominant Individuals in Accuracy Motor Performance Tasks.

John Anthony Hajus
Louisiana State University and Agricultural & Mechanical College

A COMPARISON OF CROSSED DOMINANT TO UNILATERALLY DOMINANT INDIVIDUALS IN ACCURACY MOTOR PERFORMANCE TASKS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Education

in

The Department of Health, Physical, and Recreation Education

by

John Anthony Hajus
B.S., Southern Connecticut State College, 1961
M.S., University of Bridgeport, 1962
May, 1971

ACKNOWLEDGMENTS

The writer wishes to acknowledge his sincere appreciation to Dr. Jack K. Nelson for his invaluable assistance as Major Professor. Special gratitude is also extended to the staff at the Computer Center of Southern Connecticut State College for their help with the statistics. The writer would also like to acknowledge the cooperation given to him at Istrouma Junior High, Baton Rouge, Louisiana, and Sheridan Junior High School, New Haven, Connecticut, in the collection of the data.

TABLE OF CONTENTS

CHAPTER PAGE

LIST OF TABLES

LIST OF PLATES

ABSTRACT

The purpose of this study was to investigate the hypothesis that individuals exhibiting unilateral dominance perform better in tests of throwing accuracy than crossed dominant individuals. A secondary purpose was to compare performance in throwing accuracy with both eyes open, with use of only the dominant eye, and with only the non-dominant eye.

The subjects used in this study were eighty eighth grade male students from Istrouma Junior High School, Baton Rouge, Louisiana, and Sheridan Junior High School, New Haven, Connecticut. The subjects were selected based upon the results of three tests of eye dominance, and three tests of hand dominance given to a total of 182 students. Forty subjects who displayed eye and hand dominance on the same side of the body were classified as unilaterally dominant, and forty subjects who displayed eye and hand dominance on the opposite side were classified as crossed dominant. These eighty subjects performed three tests of throwing accuracy. Each test was given twice to each subject, and the average score was recorded as the representative score. All three tests were administered under three different conditions: (1) with both eyes open; (2) with the dominant eye only; and (3) with the non-dominant eye only. A black eye patch

was worn over the eye not being tested, while the subjects were tested with only the dominant or non-dominant eye. A counter-balanced practice order was employed. All three tests were similar due to the fact that they involved throwing a ball at a stationary target. The tests differed, however, in the various types of balls used, the distances thrown, the trajectory employed in the throw, the time allowed to aim, and the starting position.

Analyses of variance, utilizing a two factor analysis with repeated measures on the same subjects were employed to determine whether significant differences existed between the unilaterally dominant individuals and the crossed dominant individuals in tests of throwing accuracy. Differences in performance when the subjects performed with both eyes, with the dominant eye only, and with the non-dominant eye only was also tested for significance.

The findings of this study were:

1. There were no significant differences between the unilaterally dominant subjects and the crossed dominant subjects on Test I, the baseball pitching test, and Test II, the basketball shooting test.

2. Unilaterally dominant subjects significantly outperformed the crossed dominant subjects on Test III, the repeated throwing test.

3. Performances in throwing accuracy were significantly superior while using both eyes than when

performing with either the dominant or non-dominant eye on all three tests of throwing accuracy.

4. There were no significant differences between performances while using the dominant eye only, and while using the non-dominant eye only on any of the three tests of throwing.

5. There was no significant interaction between the lateral dominance of the subjects and the eye(s) used in performing on any of the three tests of throwing accuracy.

Within the limits of this study the following conclusions were justified:

1. There appears to be some justification to the hypothesis that unilaterally dominant individuals outperform crossed dominant individuals in throwing accuracy, particularly in throwing tasks of greater complexity.

2. Performing while using both eyes is superior to performing with either the dominant eye only or non-dominant eye only in throwing for accuracy.

CHAPTER I

INTRODUCTION

From the beginning of life man is confronted with the problem of dominance or sidedness in the performance of motor tasks. Whether it may be a unilateral or one-sided task, or a bilateral task in which two sides of the body are employed, a choice must be made as to utilization of sides.

Oxendine[1] defined lateral dominance as the habitual use, in unilateral motor tasks, of one hand, foot, or eye in preference to the opposite member. In bilateral tasks, dominance is exhibited by the member which performs the more complex maneuvers or provides the greatest power. Dominance is also exhibited in people in smiling, chewing, winking, sleeping positions, etc. It is most easily observed however in handedness.

Theories as to the causation of dominance development have been a matter of debate from the time of Plato. Explanations of causations have been many including influences such as cerebral asymmetry, the gravity theory, origin of subclavian arteries, ocular dominance, the primitive warfare theory, the nursing theory, heredity and environment.

---

[1]Joseph Oxendine, Psychology of Motor Learning (New York: Appleton-Century-Crofts, 1968), p. 305.

Briefly explained, the cerebral asymmetry theory is that one cerebral hemisphere develops more quickly in the fetus due to a greater supply of blood and this develops a greater tendency to dominance of one side of the body. The gravity theory is that the center of gravity of the visceral organs is to the right of the median plane of the body, and this would tend to place greater weight of the body on the right leg, and thus make it easier, using the right foot as a fulcrum, to use the right hand as most individuals do. Supporters of the origin of subclavian arteries theory believe that ordinarily a greater pressure of blood is found in the right subclavian artery, and that this produces greater development of the right side. The ocular dominance theory is founded upon the idea that the dominant eye determines which shall be the dominant side. The primitive warfare theory refers to the use of the shield with the left hand to protect the heart while the right or dominant hand was used for attacking the enemy. The nursing theory is that a child learns to prefer its right hand due to the restriction of the left hand being held between its body and the nurser.

The two most accepted theories of dominance development however, have been centered around the influences of heredity and environment. Advocates of the heredity theory believe that dominance is inherited. It is believed that lateral dominance is caused by a dominant hemisphere of the brain which controls the opposite side of the body.

Cerebral dominance is believed to be transmitted by Mendelian laws of heredity. Other rationale for supporting this viewpoint lies in the fact that preference for dominance appears very early in life, and that there exists a small group of people who are more skillful with the left hand in spite of all the teaching and influences to the contrary.

The second major belief is that dominance is due to environmental factors and is strictly developmental in nature. According to this belief, all normal children can develop either right or left dominance with appropriate training. It is argued that handedness is determined by pressure to conform one way or the other, and varies with the nature of the training. Acquiring dominance follows the laws of learning and habit formation just as any other behavior that results from practice and exercise. The attitude of the parents and the child's environment are his teachers in acquiring dominance.

Durost[2] defined handedness as the demonstration of actual superiority of one hand over the other in some physical attribute or skill. The author suggested that handedness may vary with an individual, depending upon the skill involved. An individual may throw and write right handed but bat left handed. It is for this reason the author suggested that tests of handedness consist of a group of tests which

---

[2]Walter N. Durost, "The Development of a Battery of Objective Group Tests of Manual Laterality, with the Results of Their Application to 1300 Children," Genetic Psychology Monographs, 16:232, October, 1934.

are valid measure of handedness not favoring either hand but permitting a fair comparison of the relative achievement of hands.

Durost[3] in studying handedness in connection with age found that as one grows older there is less differentiation between the arms as far as the larger muscles are concerned. Where the degree of coordination was somewhat finer, no trend was found; however, where a high degree of coordination (throwing a ball) was necessary, the trend became definite in the direction of greater specialization in a particular arm.

Eye dominance has been related to hand dominance by several authorities. Hildreth[4] discussed the theory that dominant handedness originates in dominant eyedness, and that eyedness is an index of native handedness. It is theorized that the discrepancy between eyedness and handedness in later years is due to social and environmental pressures that influences the training of the right hand to become the dominant hand.

Fink[5] concluded in an early study that eyedness and handedness are to some extent related; however, the author questioned the degree that one might influence the other.

---

[3] Ibid., p. 310.

[4] Gertrude Hildreth, "The Development and Training of Hand Dominance," Journal of Genetic Psychology, 75:257, November, 1949.

[5] Walter H. Fink, "The Dominant Eye," Archives of Ophthalmology, 19:555, April, 1938.

The dominant eye is the eye which plays the major function in binocular vision. As binocular vision develops in a young child it becomes habitual to use both eyes as the unit for visual perception. Within the pattern of binocular vision however, there is a rivalry between the two eyes commonly called "retinal rivalry," with the dominant eye controlling binocular perception. The other eye, or non-dominant eye plays an assisting rather than an equal role. The non-dominant eye is used for convergence to assist in producing binocular perception. The non-dominant eye also gives the quality of depth, distance, dimension and space perception. In addition to its mastery in binocular vision the dominant eye is also the sighting eye in all monocular tasks. The two eyes therefore, like other paired organs with which man is endowed, are not equally efficient.

In man the all important motor centers for the hand and arm as well as for visual operations lie close together in the left cerebral hemisphere for the right sided and in the right cerebral hemisphere for the left sided. Individuals can be completely dominant on one side, right handed and right eyed for example, and are defined as unilaterally dominant. Other individuals can have mixed dominance, right handed and left eyed (or vice versa), and are defined as crossed dominant.

In discussing crossed dominance in relation to

sports, Mills stated:

> ...in games played with both eyes open crossed dominants are at a disadvantage compared with unilaterals. The intimate grouping of the principal motor centers is disarranged in crossed dominants, and in the transference of part of the activities to the other cerebral hemisphere a certain amount of indecision and awkwardness occurs.[6]

Hécaen[7] also endorsed the importance of lateral dominance in motor efficiency. The author stated that it cannot be denied that poor lateralization may play an important part in certain functional disorders and that good laterality is important in competent performance of motor acts.

Delacato[8] hypothesized that low learning achievement may be due to a lack of neurological organization in the cortex of the brain. The author in working with youngsters with speech and reading problems found a correlation between a lack of neurological organization in the brain and youngsters exhibiting these problems.

Delacato stated:

> Neurological organization is that physiologically optimum condition which exists uniquely and most completely in man and is the result of a total and

---

[6]Lloyd Mills, "Unilateral Sighting," California and Western Medicine, 28:191, January 1928.

[7]Henry Hécaen, Left Handedness, Manual Superiority and Cerebral Dominance (New York: Grune and Stratton, 1964, p. 143.

[8]Carl H. Delacato, The Diagnosis and Treatment of Speech and Reading Problems (Springfield, Illinois, 1963), p. 63.

> uninterrupted ontogenetic neural development. This development recapitulates the phylogenetic neural development of man and begins during the first trimester of gestation and ends about six and one-half years of age in normal humans. This orderly development in humans progresses vertically through the spinal cord and all other areas of the central nervous system up to the level of the cortex, as it does with all mammals. Man's final and unique developmental progression takes place at the level of the cortex and it is lateral.
>
> This progression is an interdependent continuum, hence if a high level of development is unfunctioning or incomplete, such as in sleep or as the result of trauma lower levels become operative and dominant. If a lower level is incomplete, all succeeding higher levels are affected both in relation to their height in the central nervous system and in relation to the chronology of their development. Man's only contribution to this organizational schema is that he has added to the vertical progression, the final lateral progression at the level of the cortex. Here again, at the cortical level, the same premises apply. The final progression must become dominant and must supercede all others. Prerequisite however to such dominance, is the adequate development of all lower levels. In totally developed man the left or the right cortical hemisphere must become dominant, with lower prerequisites met, if his organization is to become complete.[9]

Delacato indicated that complete cerebral hemispheric dominance with eye, hand and foot dominance all on the same sides of the body would be defined as neurological organization. It may therefore be assumed, according to Delacato's theory that unilateral dominance is an indication of the presence of neurological unity, and that crossed dominance indicates neurological disorganization.

Delacato[10] suggested that if man does not follow this pattern of development problems of mobility or communication

---

[9] Ibid., p. 4. [10] Ibid., p. 7.

result. To overcome such problems the author advised evaluation of the subject via the neurological schema, and imposing the areas of development upon the nervous system, beginning at the level of organization that is incomplete (spinal, pons, cortex level). Subjects begin by crawling, creeping, walking, or changing dominance of a particular eye, hand, or foot. Various methods and procedures are used. Results have shown immediate improvement in youngsters with speech, reading, and motor coordination problems.

STATEMENT OF THE PROBLEM

Although the evidence is far from conclusive, results from studies have suggested the superiority of unilaterally dominant individuals to crossed dominant individuals in motor coordination. Research however, has been confined to the areas of fine motor coordination, general motor ability, and batting in baseball. There has been a lack of research in other gross motor skills, such as in the area of throwing accuracy. Therefore, it was believed that there was a need for an investigation in which unilaterally dominant individuals were compared to crossed dominant individuals in throwing accuracy.

PURPOSE OF THE STUDY

The purpose of this study was to investigate the hypothesis that individuals exhibiting unilateral dominance

perform better in tests of throwing accuracy than crossed dominant individuals. A secondary purpose was to compare performance in throwing accuracy with both eyes open, with use of only the dominant eye, and with only the non-dominant eye.

DEFINITION OF TERMS

Ambidexterity. This term was defined as two hands exhibiting the same or approximately the same skill and being used to perform similar tasks.

Ambisinistrality. This term was defined as having neither hand developed to an adequate level of efficiency, therefore no dominance is present.

Crossed Dominance. This term was defined as dominance of a hand on one side of the body and eye dominance on the opposite side.

Dextrality. This term was defined as predominant use of the right hand.

Lateral Dominance. This term was defined as the habitual use of one hand, foot, or eye in preference to the opposite member.

Mixed Dominance. This term was defined as inconsistent performance on the six dominance tests employed in the study to determine handedness and eyedness.

Sinistrality. This term was defined as predominant use of the left hand.

Unilateral Dominance. This term was defined as dominance of a hand and eye on the same side of the body.

LIMITATIONS AND DELIMITATIONS

This study was delimited to eighy eighth grade male students. Forty students were selected from Istrouma Junior High School, Baton Rouge, Louisiana, and another forty were selected from Sheridan Junior High School, New Haven, Connecticut. The eighty students employed in the study were selected based upon the results of three tests of eye dominance and three tests of hand dominance, administered to a total of 182 students. It was assumed that the geographical difference would have no bearing on the study.

Each of the students selected for the study was administered three tests of throwing accuracy under three conditions. Each test was given twice making a total of eighteen measures for each student. With the addition of the six dominance tests, each student had a sum total of twenty-four measures.

The dominance tests were administered during eighteen sessions, each thirty minutes in length. The tests of throwing accuracy were administered during 112 sessions, each session ranging from thirty to forty-five minutes in length. The investigator tested daily, Monday through Friday, during a three week period at Istrouma Junior High School in Baton Rouge, and daily also at Sheridan Junior High School in New Haven, during a four week period, making a total of a seven

week testing period.

The subjects were asked not to engage in exercise specifically related to the tasks involved in the study. However, because the study involved tasks of throwing a ball the investigator was aware of the difficulty in the control of this problem.

All tests of throwing accuracy, at both schools, were administered in one-half of a gymnasium while a physical education class was in session in the second-half. The classes were very cooperative and did not at any time interfere, while the subjects tested did not respond at all to the classes. The activity of the classes, however, may have had some influence upon the concentration of the subjects from time to time.

SIGNIFICANCE OF THE STUDY

In many physical activities and sports the need for accuracy in throwing to a fixed or moving target is a necessary skill. Throwing accuracy plays a major role in sports such as football, basketball, and baseball, and a lesser role in many other activities. Knowledge relating to the topic is always of interest to the physical educator and coach. Since throwing accuracy is such an important skill, there is a need to determine if unilaterally dominant individuals are superior to crossed dominant individuals in throwing accuracy.

If unilaterally dominant individuals are superior to

crossed dominant individuals in throwing accuracy, it would be possible to establish homogeneous grouping based on tests of lateral dominance. Further investigation might also determine various methods that could possibly be employed in teaching crossed dominants throwing accuracy. The possibility of training individuals toward unilateral dominance could also be investigated.

CHAPTER II

REVIEW OF RELATED LITERATURE

In reviewing the literature the author found very few studies that were directly associated with the comparison of crossed dominant individuals to unilaterally dominant individuals. A considerable number of studies were found relating to lateral dominance and its relationship to motor performance. These studies were concerned with either all aspects of lateral dominance or segments, such as eye, hand, or foot.

The review of literature is presented under four main headings: (1) Studies related to lateral dominance and its relationship to motor performance; (2) Studies related specifically to hand dominance and its relationship to motor performance; (3) Studies related specifically to eye dominance and its relationship to motor performance; (4) Studies related to the comparison of crossed dominant individuals to unilaterally dominant individuals.

STUDIES RELATED TO LATERAL DOMINANCE AND ITS RELATIONSHIP TO MOTOR PERFORMANCE

Belmont and Birch[1] studied 148 elementary children in analyzing age specificity in preferential lateral usage,

---

[1]Lillian Belmont and Herbert G. Birch, "Lateral Dominance and Right-Left Awareness in Normal Children," Child Development, 34:257-270, June, 1963.

the development of right-left awareness, and the relationship between two sets of functions. All subjects were tested for lateral dominance. Hand dominance was determined by tests of ball throwing, turning a door knob, scissor cutting, and writing. Eye dominance was determined by three tasks: sighting through a kaleidoscope, sighting with a toy rifle, and sighting through a hole in a card with both eyes. Foot dominance was studied by various kicking tests.

The subject was scored right handed if he performed all four tasks with the right hand; left handed, if all four tasks were done with the left hand; and mixed, if there was any inconsistency in the performance of the tests. The eye and foot tests were scored similarly. Results showed that 76 percent of the children were right handed, 10 percent left handed, and 14 percent were mixed. Tests of eyedness showed 53 percent right eyed, 21 percent left eyed, and 26 percent mixed. Evaluation of eye-handedness showed 48 percent unilateral dominants, 16 percent pure crossed ominants, and 36 percent mixed. Tests of footedness showed 85 percent right footed, 12 percent left footed and 4 percent mixed. It was also found that clear cut establishment of eye-hand preferences could be analyzed on an age specific basis and that ambidexterity more frequently characterized the younger age groups. Test results also revealed that right-left awareness also followed a developmental course with all aspects of discrimination tending to become stabilized at

age eleven. Right-left discrimination of body parts is clearly established at age seven, two years prior to the establishment of consistent handedness, and three years prior to the stabilization of eyedness and eye-hand preferences. The appearance of right-left discrimination of the body parts at an earlier age than the clear cut establishment of handedness suggests these two functions are independent.

Similar findings were obtained by Benton and Menefree[2] in testing sixty-six students ranging in ages from four to eight years. The authors concluded that hand preference and the ability to discriminate between the right and left sides of the body were related to a small and questionably significant degree.

Sinclair and Smith[3] tested thirty-two college women students in an elementary swimming course to discover the relationship, if any, between directional choices as exhibited by swimmers in the side and crawl strokes, and hand, eye, and foot dominance. In the beginning freedom of choice

---

[2]Arthur L. Benton and Frances L. Menefree, "Handedness and Right-Left Discrimination," Child Development, 28: 237-242, June, 1957.

[3]Caroline B. Sinclair and Inez M. Smith, "Laterality in Swimming and its Relationship to Dominance of Hand, Eye, and Foot," Research Quarterly, 28:395-402, December, 1957.

was allowed for sides in breathing in the crawl stroke and swimming in the side stroke. Data concerning dominance were secured by interviewing each student and administering certain tests. It was concluded that there was a reverse relationship between the breathing side in the crawl stroke and the swimming side in the side stroke. A swimmer who breathes on the right side tends to swim on the left and vice-versa. The authors also concluded that dominance of eye, hand, and/or foot is not significantly related to side preference for breathing in the crawl stroke and swimming in the side stroke.

Fox[4] tried to discover whether an individual should be encouraged to learn a motor skill with what appears to be the dominant hand or use the preferred hand. The author tested 172 college women at the State University of Iowa in beginning bowling classes. Five tests were used to determine hand dominance. Twenty women demonstrated definite left-handedness on the tests, although through preference used the right hand in bowling. Only four of the girls could be persuaded to use their dominant hand, while the other sixteen boweled using their right hand. Tests at the conclusion of the course showed that the women who switched to their dominant hand

---

[4] Margaret Fox, "Lateral Dominance in the Teaching of Bowling," Research Quarterly, 28:327-331, December, 1957.

showed greater left hand dexterity and strength than those who did not switch; however, their bowling averages were inferior. The author noted the fact that bowling involves more than the use of the arms and that the established eye-hand-foot coordination quite possibly was more important than hand dominance.

Way[5] investigated the incidence of various laterality preferences; the relationship of lateral dominance with general motor ability; and the relationships of laterality with skills tests scores in archery, badminton, bowling, and tennis. The author tested 410 college women at the University of Washington in tests of motor ability, sports skills, and lateral dominance over a three week period. It was concluded that:

1. The majority of college women have definite eye, hand, and foot preference.
2. Motor ability seems to be related to foot ambidexterity.
3. Women who have crossed dominance are superior in motor ability to those who have unilateral dominance.
4. Eye dominance seems to have some relationship to skill in archery, badminton, bowling, and tennis.

---

[5]Eunice Way, "Relationships of Lateral Dominance to to Scores of Motor Ability and Selected Skill Tests," Research Quarterly, 29:360-369, October, 1958.

5. Laterality seems to be of more importance in the activities stressing accuracy of direction toward a fixed object than in activities which do not.

Irwin[6] investigated dominance of the upper and lower extremities and its relationship to the performance of physical education activities. Elementary and secondary school boys were used as subjects in the study. The author found that many of the subjects performing physical education activities right handed were inherently ambidexterous; whereas, the left handed subjects remained fairly constant in the performance of activities. There was close agreement between subjects' statements of handedness and actual performance. The reverse was true for footedness. There was also a definite lack of foot dominance. The author concluded that the lack of foot dominance may be partly due to a lack of social pressure in footedness.

STUDIES RELATED TO HAND DOMINANCE AND ITS RELATIONSHIP TO MOTOR PERFORMANCE

Clark[7] in a survey of over 72,000 Scottish children concluded that handedness has a heredity basis; in other words, one's chances of being left handed are greater if

---

[6]Leslie W. Irwin, "A Study of the Relationship of Dominance to the Performance of Physical Education Activities," Research Quarterly, 9:98-119, May, 1938.

[7]Margaret M. Clark, Teaching Left Handed Children (New York: Philosophical Library Inc., 1961), pp. 12-27.

there are instances of left handedness in the family. Factors other than genetic also help determine whether an individual will be right or left handed. The society in which an individual lives and its attitude toward left handedness, plus other environmental factors all influence handedness.

The influence of environmental factors upon handedness was also found in a study by Gessell and Ames[8] with children ranging in ages from eight weeks to ten years. The authors concluded that handedness was not a simple but a complex trait subject to many variables and was a product of growth.

Ojemann[9] administered five hand dominance tests to 518 pupils in grades three through eight. Results showed relatively few ambidexterous individuals, with most subjects being either right or left handed. The author concluded that handedness appears to be a general factor which divides individuals into two groups. It was also concluded that a single test cannot be used to differentiate accurately between groups due to a considerable overlapping of scores. However, when a group of tests are combined the amount of overlapping is relatively small.

---

[8]Arnold Gessell and Louise Ames, "The Development of Handedness," Journal of Genetic Psychology, 70:155-175, February, 1947.

[9]R. H. Ojemann, "Studies in Handedness," The Journal of Educational Psychology, 21:597-611, November, 1930.

Provins[10] used tasks involving three levels of complexity to test handednes and skill. The simplest task measured the accuracy with which a particular pressure could be reproduced in isometric contraction of the flexors of the index finger on each hand in twenty-one female subjects. In the second situation the maximum speed of making an attempted tapping movement under the same conditions was measured in ten of the same subjects using the same muscle group alternating with its antagonists. The same ten subjects were also tested on aiming tasks which provided the same level of complexity. The results suggested that differences in performance between the two sides existed only where timing of the various muscles was necessary. In making simple muscular contractions, one hand is no better than the other, providing the timing factor is not present. In any movement requiring serial organization of muscle activity, the timing of the component parts of the movement, then the hand used, becomes an important factor. The author suggested that this difference was due to the extent of differentiated training on the two sides, rather than inherited characteristics. This was supported by a second experiment conducted on the same subjects, using the big toe instead of the index finger, where no previous training

---

[10] K. A. Provins, "Handedness and Skill," The Quarterly Journal of Experimental Psychology, 8:79-95, February, 1956.

could have taken place.

Smith and Lewis[11] tested the steadiness between the preferred hand and the non-preferred hand of thirty boys. The results obtained showed no significant difference between the scores of the preferred and non-preferred hands.

Vogel[12] studied twenty members of the varsity baseball team at the University of Iowa to investigate the relationship of dominance to batting and throwing a baseball. Results showed that inherently right dominant individuals both throw and bat right handed. The inherently left dominant individuals showed a mixed behavior in performing the acts of batting and throwing. However, the majority of left dominant individuals showed right handed responses. The author concluded that handedness is an inherited characteristic, subjected to social conditioning. It was also concluded that certain acts are more subject to environmental influence than others.

---

[11] Leon E. Smith and Floyd D. Lewis, "Handedness and its Influence upon Static Neuromuscular Control," Research Quarterly, 34:206-212, May, 1963.

[12] O. H. Vogel, "The Relationship of Dominance to Acts of Skill, Research Quarterly, 6:15-18, October, 1935.

STUDIES RELATED TO EYE DOMINANCE AND ITS RELATIONSHIP TO MOTOR PERFORMANCE

Zagora[13] in studying pre-school and school aged children concluded that by age three the majority of children show eye dominance and that by age five about ninety-five percent become definitely right or left eyed.

Hildreth[14] found similar results in finding that children were apparently ambi-eyed at birth and for some time after, but that eye dominance developed as soon as sighting was required with the using of implements. At that point the eye and hand seemed to function together. The author concluded that eye dominance increases with age suggesting it is an acquired visual motor habit.

Freeman and Chapman[15] tested forty male subjects in a group pursuit test in attempting to determine the importance of eye and hand dominance in a pursuit skill. The subjects traced in ink upon cellophane the movement of a dot as seen in the mirror lying below the writing surface. Results showed that hand dominance played a more important role in the pursuit skill than eye dominance. It was also found that both eye and hand dominance played an important

---

[13]E. Zagora, "Observations on the Evolution of Neurophysiology of Eye-Limb Coordination," Ophthalmology, 138:241-254, April, 1959.

[14]Gertrude Hildreth, "The Development and Training of Hand Dominance," Journal of Genetic Psychology, 75:255-275, November, 1949.

[15]G. L. Freeman and J. S. Chapman, "The Relative Importance of Eye and Hand Dominance In a Pursuit Skill," The American Journal of Psychology, 47:146-149, January,1935.

role in the early stages of learning, but lessened in importance as time continued.

Lund[16] tested 247 high school and college students in testing the hypothesis that vision is monocular in all adjustments calling for a high precision of the eyes and hands. The author theprized that eye dominance is closely linked with monocular space perception and the general problem of sidedness. Space perception is monocular in the case of all objects seen indirectly, for the reason that objects will appear double when viewed with both eyes. Accordingly, adjustments to these objects are guided by only the dominant eye. This is particularly true in the case of eye-hand adjustments calling for close coordination. In this case it is the hand that is seen indirectly, since the eyes are trained upon the point of adjustment rather than on the adjusting member. The author hypothesized that the dominant eye should be the one on the same side as the controlling member to be in the best interest of efficiency.

A simple target test was administered to the subjects under three conditions: both eyes open, right eye covered, and left eye covered. Results showed that the scores for the dominant eye were significantly greater than the non-

---

[16] F. H. Lund, "The Dependence of Eye-Hand Coordination Upon Eye Dominance," American Journal of Psychology, 44:756-762, December, 1932.

dominant suggesting that the dominant eye plays a more important role than the non-dominant. However, since the best scores were made with both eyes open, the author concluded that binocular as well as monocular vision enters into eye-hand adjustments. It was also concluded that there appears to be an advantage in having the dominant eye on the same side as the controlling member.

In a later study, Fink[17] substantiated these findings. In studying 125 children, he found that the highest degree of coordination existed in the children who had the dominant eye and the dominant hand on the same side of the body.

Over 1,000 British infantry men were tested by Bannister[18] in studying the effect of the dominant eye on shooting ability. Results showed that the dominant eye is an important factor affecting ability with the rifle, and that the men whose right eye is dominant have a considerable advantage over other men when required to shoot from the right shoulder.

---

[17] Walter H. Fink, "The Dominant Eye," Archives of Ophthalmology, 19:555-582, April, 1938.

[18] Henry Banister, "A Study in Eye Dominance," The British Journal of Psychology, 27:34-42, January, 1935.

STUDIES RELATED TO THE COMPARISON OF CROSSED DOMINANT INDIVIDUALS TO UNILATERALLY DOMINANT INDIVIDUALS

Robinson[19] tested 100 junior high school boys in investigating the hypothesis that subjects indicating unilateral dominance perform better in tests of reaction time and hand-eye coordination than crossed dominant subjects. Tests of eye and hand dominance classified the subjects into two groups. The subjects then performed a battery of tests involving five areas ofmeasurements; reaction time, time in large muscle hand-eye movement, accuracy in large muscle movement, time in small muscle hand-eye movement, and accuracy in small muscle movement. It was found that the unilateral group significantly outperformed the crossed dominant in four out of the five areas measured. Only with accuracy in large muscle movement was it found that both groups were equal. The author concluded that unilaterally dominant individuals have better coordination than crossed dominant individuals.

Similar results were found by Adams[20] who tested thirty-two college baseball players in order to determine the effect of eye dominance on baseball batting. The

---

[19]Edwin Nelson Robinson, "A Comparison of Laterally Dominant to Crossed Dominant Individuals in Tests of Reaction Time and Hand-Eye Coordination," Microcard, M.A. Thesis, University of California at Santa Barbara, Santa Barbara, 1965, p. 65.

[20]Gary L. Adams, "Effect of Eye Dominance on Baseball Batting," Research Quarterly, 36:3-9, March, 1965.

author investigated the theory that the dominant eye plays a more important role in the task of batting than the other. Based on this theory it is claimed by some baseball coaches that the crossed dominant batter has an advantage over the unilateral due to the position of the batter's dominant eye in relation to the pitched ball. Each subject was tested for eye and hand dominance and then divided into two laterality groups. The two groups were then compared on their batting performances. Comparisons were made on the basis of base average, batting average, strike outs, called strike outs, and missed swings. Results showed that the unilaterals scored better in most of the categories. The author concluded that the eye dominance factor must be seriously considered as having an effect on batting performance.

A similar study was conducted by Baughman[21] in comparing crossed dominant to unilateral dominant varsity baseball players at the University of Maryland. The players hit balls projected from an automatic pitching machine and were scored according to placement of line drives in specific parts of the field. No significant differences were found

---

[21]Larry Baughman, "Two Methods of Determining the Effects of Sighting Dominance on Baseball Hitting," MA Thesis, University of Maryland, 1968, College Park,cited in Completed Research in Health, Physical Education, and Recreation, Vol.II, ed. Robert N. Singer and Raymound A. Weiss (Washington: American Association for Health, Physical Education, and Recreation, 1969,) p. 132.

between the two groups, although there was a significant difference in favor of using both eyes as compared to using only the dominant or non-dominant eye. In a second phase of the study fifty-eight members of the International League were examined concerning their batting performance. No significant differences were found except that the crossed dominant batters achieved a significantly higher number of bases on balls than did the unilateral group.

Horine[22] tested 220 boys ten years of age to measure the relationship of lateral dominance to performance on selected motor ability tests. On the basis of eye, hand, and foot dominance tests four groups were composed: (1) pure right sided individuals, (2) predominantly right sided individuals, (3) mixed dominance, and (4) pure left or predominantly left sided individuals. Four motor ability tests were then administered to the subjects. Results showed no significant differences between the groups although the unilaterals consistently outperformed the crossed dominant individuals.

Eyre[23] studied subjects at Scripps College to establish

---

[22]Lawrence Horine, "An Investigation of the Relationship of Laterality Groups to Performance on Selected Motor Ability Tests," Research Quarterly, 39:90-95, March,1968.

[23]Mary B. Eyre, "Studies in Eye, Hand, and Foot Preferences," The Journal of Juvenile Research, 22:109-114, April, 1938.

the meaning of eye, hand, and foot dominance in relation to personality maladjustment and to reading and writing difficulties. It was found that crossed dominance existed to a significant degree in the mentally subnormal, the psychotic, and the emotionally unstable adolescents as compared to the unilaterally dominant.

Cornell[24] substantiated these findings in investigating the hand, eye, and foot preferences of 200 psychotic patients at a state hospital in California and 200 college students. The author concluded that there is apparently a relationship between psychotic personality and crossed dominance and also apparently between psychotic personality and absence of distinct hand, eye, and foot preference.

Additional studies by Dart[25], who studied mentally subnormal patients at a state hospital and public school children, and Turner[26], who studied junior high school students, found similar results as the two previous studies.

---

[24]Constance Cornell, "Eye, Hand, and Foot Preferences of Psychotic Patients Compared With College Students," The Journal of Juvenile Research, 22:115-118, April, 1938.

[25]Carroll Dart, "Eye, Hand, and Foot Preference of Mentally Subnormal Subjects Compared With Individuals of Normal or Superior Intelligence," The Journal of Juvenile Research, 22:119-121, April, 1938.

[26]Edith Turner, "Eye, Hand, and Foot Preferences of Emotionally Unstable Adolescents Compared with Stable Adolescents," The Journal of Juvenile Research, 22:122-124, April, 1938.

Both studies found a significant relationship between crossed dominance and mentally subnormal and emotionally unstable individuals.

Trembley[27] investigated the theory that violations of the natural unilateral dominance, through continued use of the right hand by natural left handers, may tend to cause neural tension. The author studied the eye and hand dominance of ninety-eight poliomyelitics at the Rehabilitation Center at the University of Illinois. It was found that the crossed dominant individuals were more frequently paralyzed than the unilaterally dominant individuals. It was also found that the paralysis of crossed dominants was more frequent and more severe on the right side. The author suggested that crossed dominant children may be in some way more susceptible to the virus of poliomyelitis. One or two mechanisms could be operating. First, crossed dominant children, with an excess of nervous energy may play harder than other children resulting in a greater degree of fatigue. Second, the nervous tension itself over a period of time may be stressful, thus increasing the vulnerability of the neural system.

---

[27]Dean Trembley, "Crossed Dominance of Hand and Eye in Relation to Poliomyelitis," Perceptual Motor Skills, 26:231-234, February, 1968.

SUMMARY OF RELATED LITERATURE

In two studies it was concluded that handedness has a heredity basis, although both suggested that factors other than genetic also help determine handedness. In a third study it was concluded that handedness is a product due strictly to environmental factors and growth.

Results of two studies found that a majority of children are right handed with very few being ambidexterous. It was also noted that ambidexterity more frequently characterized the younger age groups.

In one study it was found that right-left discrimination of body parts is established at age seven, two years prior to the stability of eyedness. Results of this study together with another, also suggested that hand preference and the ability to discriminate the right and left side of the body are most likely independent.

Different findings were reached by another study which concluded that by age five most children establish eye dominance. Results of another study indicated similar results and also concluded that eye dominance increases with age suggesting it is an acquired visual motor habit.

In one study it was found that many subjects performing physical education activities right handed were inherently ambidexterous; whereas, the left handed subjects remained fairly constant in the performance of activities.

Slightly different results were found in a study investigating batting and throwing. Results showed inherently right dominant individuals both throw and bat right handed. The inherently left dominant individuals showed a mixed behavior in performing the acts of batting and throwing.

A steadiness test was utilized in a study to find no significant differences in scores of the preferred and non-preferred hands.

In another study it was concluded that in making simple muscular contractions, one hand is no better than the other. In making movement requiring serial organization of muscular activity however, the hand used is an important factor.

Results of one study showed that dominance of eye, hand and/or foot is not significantly related to side preference for breathing in the crawl stroke, and swimming in the side stroke. Similar findings were reached in another study that suggested eye-hand coordination is probably more important than hand dominance in the activity of bowling.

In one study it was found that eye and hand dominance play an important role in the early stages of learning a new skill, but lessened in importance as time continued.

In two studies it was established that there appears to be an advantage in having the dominant eye on the same side as the controlling hand in eye-hand coordination.

Results of two studies indicated better performances on tests with subjects keeping both eyes open, than the use

of the dominant eye only.

It was concluded in one study that the dominant eye is an important factor affecting shooting ability with a rifle.

In two studies it was found that in comparing unilaterally dominant individuals to crossed dominants, the unilaterals significantly outperformed the crossed dominants. Both authors concluded that eye dominance was a factor that must be considered in motor performance.

In one study no significant differences were revealed in the comparison of unilaterals with crossed dominants, but it was noted that the unilaterals consistently outperformed the crossed dominants in tests of motor ability.

Dissimilar findings were reported in another study in which the results showed that the crossed dominant individuals were superior in motor ability. It was also concluded that eye dominance seems to have some relationship to skill in archery, badminton, bowling, and tennis. The author also suggested that laterality seems to be of more importance in activities stressing accuracy of direction toward a fixed target than in activities which do not.

Results of one study showed no significant differences in batting performances of crossed dominant individuals to unilaterally dominant individuals.

Findings of four studies reported that crossed dominance existed to a significant degree in the mentally subnormal,

psychotic, and emotionally unstable.

In one study it was found that crossed dominance existed in a significant number of poliomyelitics.

CHAPTER III

PROCEDURE

OVERVIEW

Three tests of eye dominance and three tests of hand dominance were administered to 182 eighth grade male students. Based upon the results of these tests, forty subjects exhibiting unilateral dominance, and forty subjects denoting crossed dominance were selected to perform three tests of throwing accuracy. All three tests were similar and involved throwing a ball at a stationary target. The tests differed, however, in the various types of balls used, the distances thrown, the trajectory employed in the throw, the time allowed to aim, and the starting position. Test I was related to pitching in baseball and Test II to a player shooting in basketball. Test III related to situations where it is necessary to first catch the ball then throw at a target with a limited amount of time for taking aim.

Each test was administered twice to each subject with the average score recorded as the representative score. Differences in performance under the conditions of throwing with both eyes open as compared to the use of only the

dominant or non-dominant eye were also analyzed. The tests were administered during the months of Decemter, 1970, and January, 1971.

PILOT STUDY

A pilot study was conducted by the investigator during the second and third weeks in November 1970, at Istrouma Junior High School, Baton Rouge, Louisiana. Forty seventh grade boys were used as subjects during four sections of physical education classes. All subjects were administered six tests, three for eye dominance, and three for hand dominance to familiarize the investigator with the procedures of administering the tests. The results of these tests were also studied to determine the percentage of unilateral and crossed dominant subjects available to the investigator among a group of forty subjects. Thirty-three subjects were randomly selected to continue further in the study.

During the first class each day three subjects participated in the three tests of throwing accuracy which were later selected for the main study, plus two other tests which were eliminated. The purpose was to experiment with various distances, heights, sizes of targets, to determine three tests that would discriminate most effectively in throwing accuracy. During the following three class periods each day thirty subjects participated in the tests to determine the reliability of the tests. Listed below are the

reliability measures of thirty trials with each of the selected tests, using the split-halves method, requiring the employment of the Spearman-Brown Prophecy Formula:

Test I = r. 77

Test II = r. 86

Test III = r. 71

During the second class period four of the subjects participated in each of the tests under the three conditions that were employed in the study. This enabled the investigator to become familiar with the testing conditions. Factors such as the time necessary to administer a test, methods of administering a test to a group of students, and methods of recovering thrown balls, were examined.

SUBJECTS

Eighth grade male students at Istrouma Junior High School, Baton Rouge, Louisiana, and Sheridan Junior High School, New Haven, Connecticut were employed as subjects in the study. Hand and eye dominance tests were administered to 182 subjects. Based upon the results of these tests, forty crossed dominant individuals and forty unilaterally dominant individuals were selected to participate in the study.

At Istrouma Junior High School eighty subjects were selected from four sections of physical education classes. Upon completion of the hand and eye dominance tests, ten students from each section were selected to participate in

six additional testing sessions lasting thirty minutes in length. Including the session for testing hand and eye dominance, each of the forty subjects selected for the study participated in seven sessions lasting thirty minutes in length, totalling three and one-half hours. However, each subject only took part in forty minutes of actual testing activity during this time.

A similar schedule was followed at Sheridan Junior High School Dominance tests were administered to 102 subjects selected from four sections of physical education classes and four sections of study halls. Upon completion of the dominance tests forty subjects were selected to participate in the six additional sessions. Each session lasted forty-five minutes in length, totalling five hours of testing time for each subject selected. However, the time each subject participated in actual testing activity remained forty minutes.

TESTING EQUIPMENT

Blackboard. A blue portable blackboard, eighteen by twenty-four inches in diameter with a red dot in the center one-half inch in diameter was used in testing eye dominance.

Cardboard. One gray cardboard eight and one-half by eleven inches in diameter with a hole in the center of it one-quarter inch in diameter was employed in testing eye dominance.

Eye Patches. Five black eye patches with elastic head bands were employed in the tests of throwing accuracy.

Handballs. Fifteen regulation black rubber handballs were employed in a test of throwing accuracy.

Needles. Ten gold sewing needles were used in testing hand dominance.

Playground Balls. Two red playground balls seven inches in diameter were employed in a test of throwing accuracy.

Rope. One piece of rope, one-quarter inch in diameter and five feet in length was used in a test of throwing accuracy. Additional rope was employed in suspending a canvas target from the supports of a basketball backboard in another test of throwing accuracy.

Softball Bat. One softball bat, thirty-three inches in length was used in testing hand dominance.

Stopwatch. One regulation stopwatch was employed in a test of throwing accuracy.

Tape. One and a half inch strips of red plastic tape were used on the floor as boundaries in the tests of throwing accuracy.

Targets. Two targets, each on a different side of a large brown canvas, eight by eight feet in size were employed in the tests of throwing accuracy. The first target had three white concentric circles all one inch in width. The inner circle was eighteen inches in diameter, the center circle thirty-eight inches in diameter, and the outer circle fifty-eight inches in diameter. The center circle was colored entirely in white. The second target also had three white

concentric circles all one inch in width. The inner circle was ten inches in diameter, the center circle twenty-five inches in diameter, and the outer circle forty inches in diameter. See Plates I and II.

Telescope. One black toy telescope ten inches in length was employed in testing eye dominance.

Tennis Balls. Ten regulation tennis balls were employed in tests of hand dominance and throwing accuracy.

Thread. Pieces of black thread were employed in testing hand dominance.

Trough. One red wooden trough standing three feet eight inches in height, and five feet in length was employed in a test of throwing accuracy. See Plate III.

Volleyball Standards. Two regulation volleyball standards were employed in the tests of throwing accuracy.

TESTING PROCEDURE

During the first two days of testing at Istrouma Junior High School, eighty eighth grade boys were randomly selected from four sections of physical education classes. On the first day, ten boys from each section were tested for eye and hand dominance. The testing took place in a corner of the gymnasium. Each boy sat in one of ten chair-desks which were arranged in a semi-circle. Preliminary instructions were given by the investigator explaining briefly the purpose of the testing and requesting that each subject

PLATE I

TARGET EMPLOYED IN BASEBALL PITCHING AND REPEATED THROWING TESTS

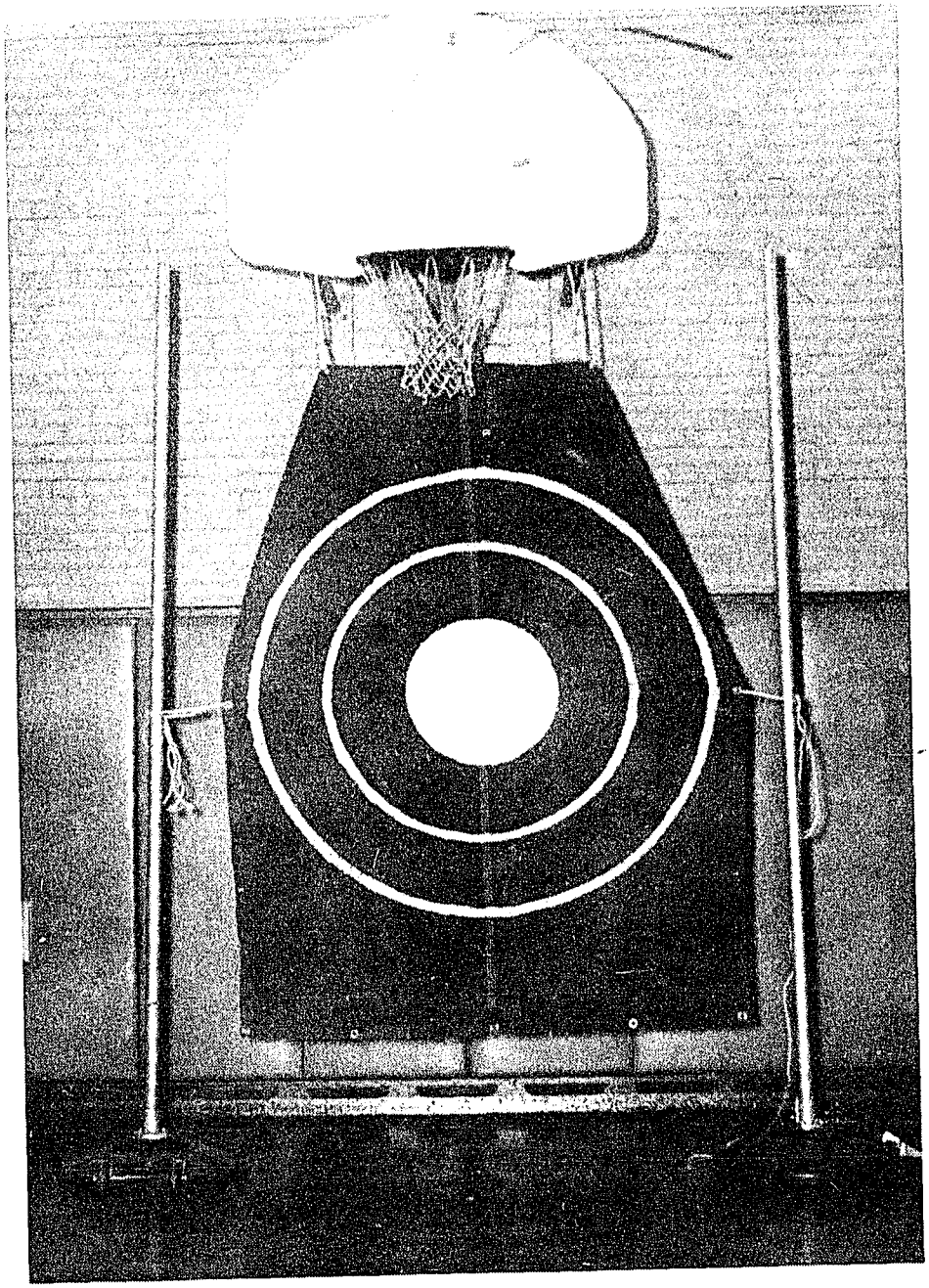


PLATE II

TARGET EMPLOYED IN BASKETBALL SHOOTING TEST

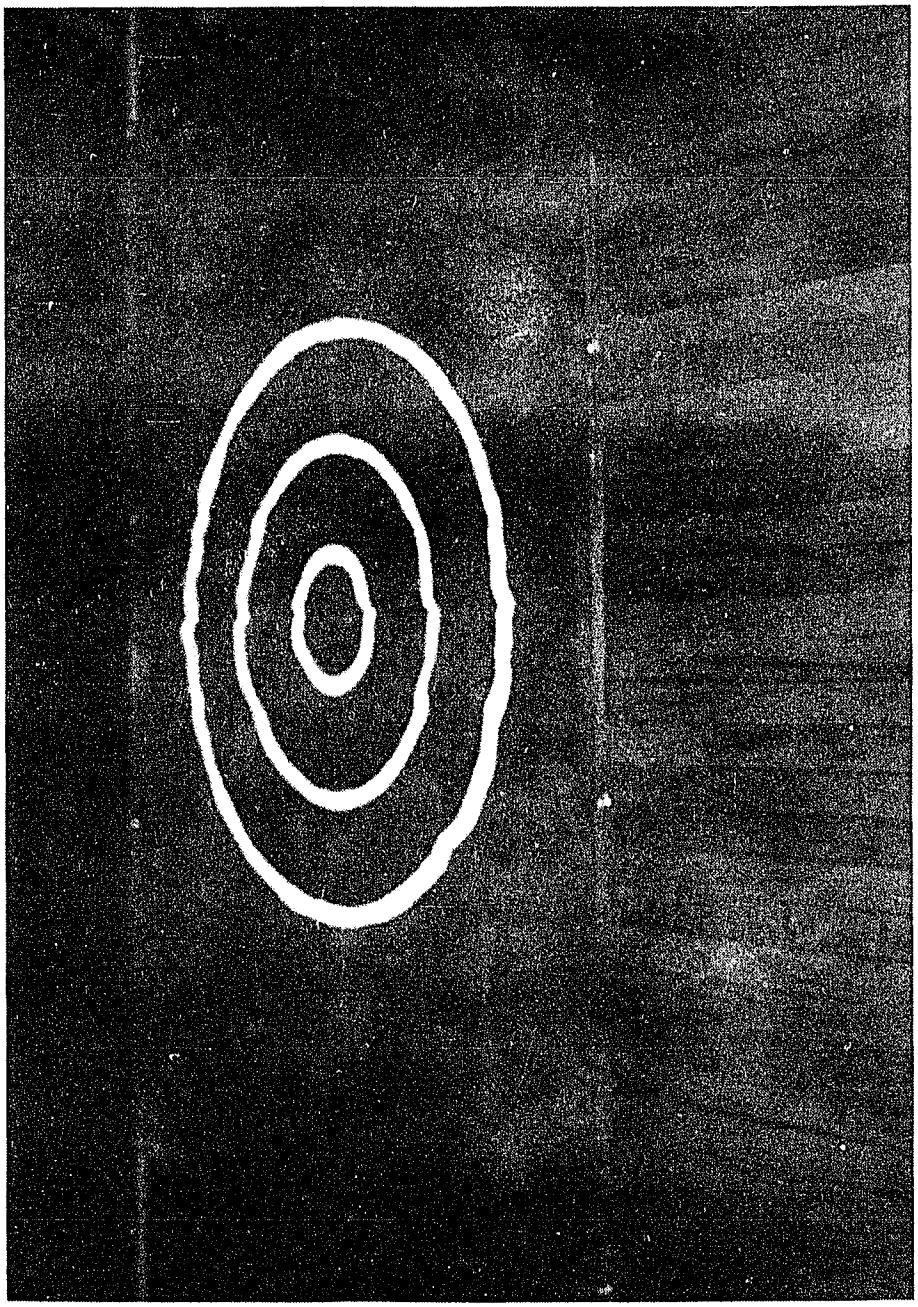
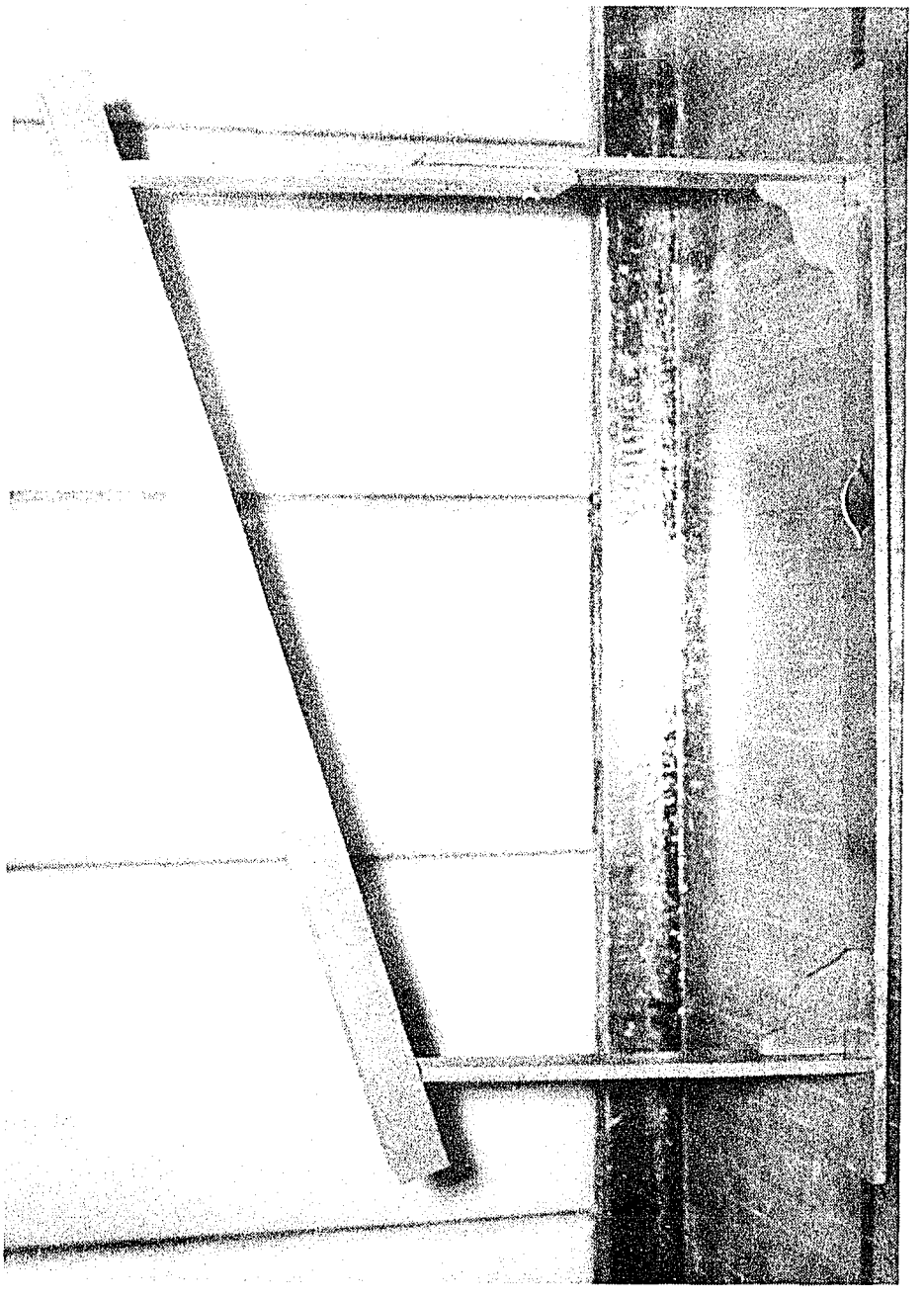


PLATE III

TROUGH EMPLOYED IN REPEATED THROWING TEST



carefully follow all given instructions.

Each subject was administered six tests, three for eye dominance and three for hand dominance. All ten subjects completed the first test before the investigator proceeded with the next. The eye dominance tests were administered first, with the hand dominance tests following. All scores were recorded by the investigator upon a score sheet established for this purpose. A subject whose scores showed consistent performance in all three tests of an area of measurement, was considered "pure dominant" in that area. A subject whose scores showed performances of two measures on one side and a third on the opposite side was considered "mixed dominant." All "mixed dominant" dominant subjects were eliminated from the study. Subjects with "pure dominance" in the eyes and hands on the same side of the body were apprasied as unilaterally dominant, and those with eye dominance on one side, and hand dominance on the opposite side were appraised as crossed dominant. The following day forty additional students were tested. Each testing session lasted approximately thirty minutes.

Subjects defined as unilaterally dominant or crossed dominant were considered by the investigator to participate further in study. Since the results of the pilot study revealed that only approximately twenty-five percent of the population is crossed dominant, the investigator was prepeared to select all crossed dominants established by the testing.

Only twelve crossed dominants were found, and all were selected to participate in the tests of throwing accuracy. Twenty-eight unilaterals were also selected, all because of their availability to fit into a previously established testing schedule. Altogether forty subjects, twelve crossed dominant, and twenty-eight unilaterally dominant subjects were selected to participate in the tests of throwing accuracy.

The same basic procedure for testing eye and hand dominance was employed at Sheridan Junior High School. However, since the purpose of this study was to compare forty unilaterally dominant subjects, it became necessary to meet that requirement. Hand and eye dominance tests were administered to 102 subjects from four sections of physical education classes and four sections of study halls during a three day period. Upon completion of the dominance tests forty students, twenty-eight crossed dominant and twelve unilaterally dominant were selected to participate in the tests of throwing accuracy. All procedures for testing were similar to those previously discussed.

The following tests of eye and hand dominance were administered:

Eye Dominance - Test I. A black telescope was placed on the desk in front of the subject. The subject was requested to pick the telescope up using two hands and focus upon a distant target selected by the investigator. The eye to which the subject brought the telescope was considered the dominant

eye for this test.

Eye Dominance - Test II. A dot one-half inch in diameter on a blackboard was placed at eye level seven feet away from the seated subject. The subject was handed a cardboard 8½ x 11 inches with a quarter inch hole in the center. The subject was instructed to hold the cardboard at arm's length in front of him, and to move the cardboard accordingly in order to see the dot on the blackboard through the hole in the cardboard. Upon sighting the dot, the subject was instructed to not move the cardboard, but to close his right eye and inform the investigator if the dot could still be seen. The same procedure was used for the left eye. The eye with which the subject could still see the dot was considered the dominant eye for this test.

Eye Dominance - Test III. Using the same equipment as in test number two, the subject was again asked to hold the cardboard at arm's length so that the dot on the blackboard could be seen through the hole. Upon sighting the dot, the subject was instructed to bring the cardboard slowly back to the face without losing sight of the dot. The eye to which the hole was brought was considered the dominant eye for this test.

Hand Dominance - Test I. A sewing needle and a piece of black thread was placed on the desk in front of the subject. The subject was asked to slip the thread through the "eye" or little hole in the needle, moving only the hand holding

the thread, keeping the hand holding the needle perfectly still. Observance was taken as to which hand the subject used to hold the thread. This hand was considered the dominant hand for this test.

Hand Dominance - Test II. A softball bat was placed on the floor in front of the subject. The subject was instructed to pick the bat up and emulate a baseball type swing. The shoulder from which the subject swung the bat was considered the dominant side or hand in this test. Any "cross handed" swinging was disregarded.

Hand Dominance - Test III. A tennis ball was placed on the floor in front of the subject. The subject was instructed to pick the ball up and throw it to the investigator who was at a distance of thirty feet away. The hand the subject used to throw the ball with was considered the dominant hand.

Tests of Throwing Accuracy

All of the eighty subjects that were selected received three tests of throwing accuracy. At Istrouma Junior High School twenty subjects were tested for six consecutive school days. Each testing session involved five subjects and lasted approximately thirty minutes. All testing took place in one-half of a gymnasium. Upon conclusion of the testing with the first twenty subjects, an additional twenty were tested in a similar manner. Altogether, forty subjects were administered the tests of throwing accuracy in twelve consecutive school

days. With the addition of the dominance tests, all testing for the study at Istrouma was administered in fourteen school days or approximately three weeks.

A similar schedule was followed at Sheridan Junior High School. However, due to absentees, it was necessary to employ sixteen school days to administer the tests of throwing accuracy. With the addition of the dominance tests, all testing was administered in nineteen school days or approximately four weeks.

Each test was given twice to each subject, and the average score was recorded as the representative score. All three tests were administered under three different conditions: (1) with both eyes open; (2) with the dominant eye only; and (3) with the non-dominant eye only. A black eye patch was worn over the eye not being tested, while the subjects were tested with only the dominant or non-dominant eye. Each day a subject would receive one test under three conditions. The following day the test would be repeated and the average scores recorded. Altogether each subject received all three tests under all three conditions twice, totalling eighteen individual tests in all.

A counter-balanced practice order was employed since all subjects took all the tests under all three conditions. The following procedure was employed:

Eye Conditions	Unilateral Subjects		Crossed Dominant Subjects	
Both-Dom.-N.Dom.	first	13	first	14
Dom.-N.Dom.-Both	second	13	second	13
N.Dom.-Both-Dom.	last	14	last	13
		40		40

In employing the three tests of throwing accuracy the investigator sought to relate Test I to pitching in baseball, and Test II to shooting in basketball. Test III was not proposed with any particular sport or activity in mind, but an attempt was made to relate to a situation whereupon an individual had to make repeated throws at a target with a limited amount of time for taking aim. Test III also attempted to associate with situations where an individual had to first catch a ball prior to making a throw for accuracy at a target, such as an infielder in baseball. All three tests were tests of throwing accuracy at a stationary target. The tests differed however in the following ways:

1. Balls. Test one employed a tennis ball, test two a small playground ball, and test three a handball.

2. Distances. On test one all subjects threw from thirty-three feet, test two from fifteen feet, and test three from twenty feet.

3. Trajectory. On tests one and three very little trajectory was employed, and the flight of the ball was in a horizontal manner. On test two, an arching of the path of the ball was necessary to perform the test.

4. Time to Aim. On tests one and two the subject took as much time as he desired to aim, however on test three the time period for aiming was limited.

5. Starting Position. On tests one and two, the subject started with the ball in his hands, however on test three he had to first catch the ball prior to throwing it.

Test I. Each subject had ten throws with a tennis ball at a canvas target thirty-three feet away. The target had three

concentric circles each one inch in width (See Plate I, p. 40). The target was suspended from the supports of a basketball backboard with a rope. To keep the target taut the two sides of the target were tied with a rope to two adjacent volleyball standards. All subjects were instructed to throw overhand. The subjects remained behind a boundary line marked with six inch strips of red plastic tape while performing. The investigator handed the balls to the subjects one at a time from a small bucket to assure a consistent pace and to avoid any hurried throwing. Three points were awarded if the ball hit inside the inner circle, two points if the ball hit inside the center circle, and one point for hits inside the outer circle. Balls hitting on a line were given the higher point value. All scoring was done by the investigator. At the completion of the ten throws all points were added up and the score recorded on a prepared score sheet (See Plate IV, p. 50).

Test II. Each subject had ten throws with a seven inch playground ball at a canvas target lying on the floor fifteen feet away. The target had three concentric circles each one inch in width (See Plate II, p. 41). Between the target and the subject was a rope six feet six inches high, attached to two volleyball standards, and parallel to the floor. The rope was five feet from the subject. The subject had to arch the ball over the rope, in throwing at the target.

PLATE IV

SUBJECT PERFORMING BASEBALL PITCHING TEST

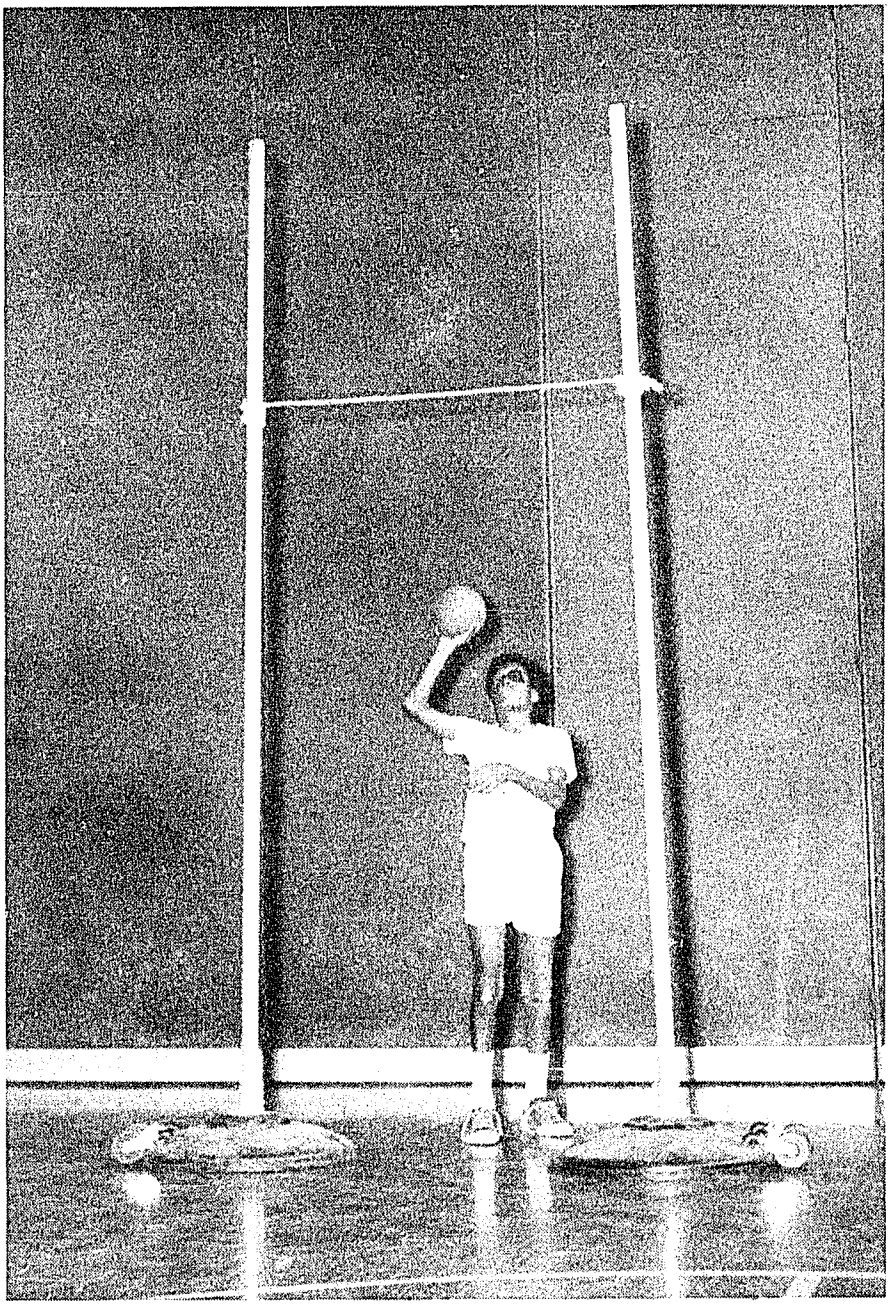
The subject threw with one hand, in an overhand manner. The subject remained behind a boundary line marked with red tape while performing. The scoring system was identical to the one employed in Test I (See Plate V, p. 52).

Test III. Each subject stood facing a wooden trough four feet eight inches away. Every two seconds a rubber handball was rolled down the trough and bounced once on the floor between the subject and the trough. The subject fielded the ball with one or two hands, turned to the left and threw at a suspended canvas target twenty feet away. The target was a solid white circle eighteen inches in diameter (Plate I). It was located at a right angle to the subject's position. The ball bounced two feet away from the trough, and up to the subject about twenty-two inches off the floor. The subject was given a new ball every two seconds for thirty seconds. The subject had fifteen opportunities to catch the ball and turn and throw at the target. After each throw, the subject had to focus his attention back to the trough for a new ball. If a ball was not caught, the subject was instructed to forget about that ball and wait for the succeeding one. One point was awarded each time a throw hit the solid white circle. All scoring was done by the investigator. At the completion of the thirty seconds all points were totalled.

Two assistants were instructed in the method of releasing the handballs. One assistant handled a stopwatch.

PLATE V

SUBJECT PERFORMING BASKETBALL SHOOTING TEST



Every two seconds he would call out the word "ball" and continue to read the stopwatch. A second assistant fed the handballs by releasing a handball at the top of the trough upon hearing the word "ball." In a very few instances there was a break in the succession of the balls due to an error in their release. If the break occurred on the first or second ball, the subject was retested from the beginning. If, however, the break occurred after the second ball, the subject was retested from that particular point. At no time was there more than one break on a single subject.

In situations where the subject tested was left-handed, the trough was transferred to the opposite side of the gym floor and the subject threw turning to his right rather than his left. The subject's relationship with the target or the trough did not change because a subject was right or left handed (See Plate VI, p. 54).

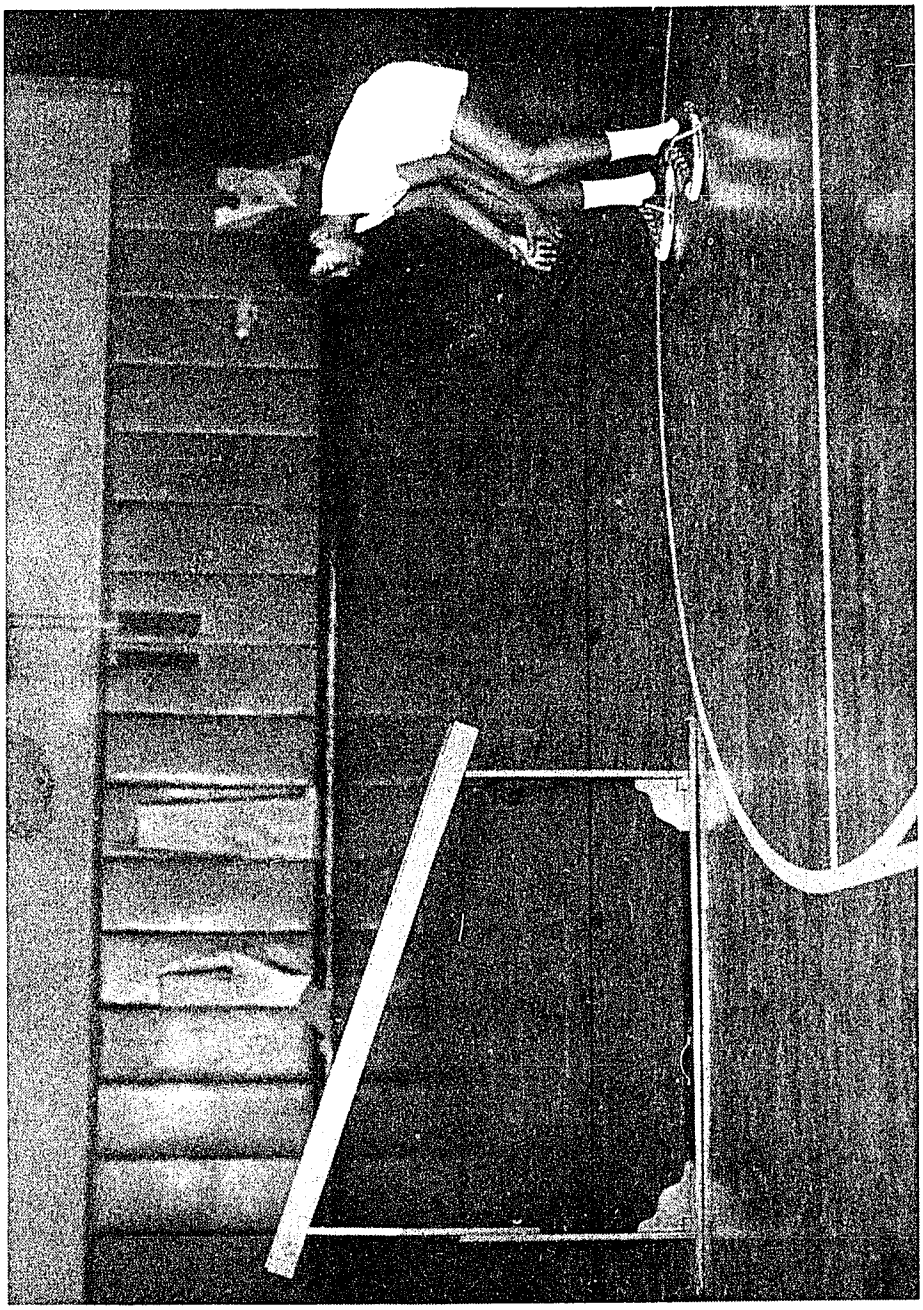
TREATMENT OF DATA

The representative score for each subject was determined by averaging the two scores received due to the repetition of the tests. Each subject had nine scores, three for each of the three tests of throwing accuracy.

The data were processed at the Computer Center of Southern Connecticut State College, New Haven, Connecticut. Mean scores were computed for the two groups, unilateral and crossed dominant, and also for the three conditions, both eyes, dominant eye, and non-dominant eye. Analysis of variance, utilizing a two factor analysis with repeated measures

PLATE VI

SUBJECT PERFORMING REPEATED THROWING TEST



on the same subjects, was utilized to determine whether significant differences existed between the unilaterally dominant individuals and the crossed dominant individuals in tests of throwing accuracy. This statistical design also determined whether significant differences existed in performance of the tests when the subjects performed with both eyes, with the dominant eye only, and with the non-dominant eye only. Interaction between the lateral dominance of the subjects and the eye(s) used in performing was also tested for significance. This statistical procedure was repeated for each of the three tests of throwing accuracy.

Orthogonal comparisons were used by the investigator to determine the nature of the significant differences found in the computation of anlaysis of variance.

Data received on the three tests of eye dominance and three tests of hand dominance were also analyzed. Percentages were computed for eye and hand dominance, crossed and unilateral dominance, and mixed dominance.

CHAPTER IV

ANALYSIS AND PRESENTATION OF DATA

INTRODUCTION

The data in this study consisted of test scores of eighth grade male subjects on six tests of eye and hand dominance and three tests of throwing accuracy. Results from three eye dominance and three hand dominance tests on 182 subjects were analyzed. Percentages were computed for eye and hand dominance, crossed and unilateral dominance, and mixed dominance. Analysis of variance, utilizing a two factor analysis with repeated measures on the same subjects, was computed to determine whether significant differences existed between the unilaterally dominant subjects and the crossed dominant subjects in the tests of throwing accuracy. This statistical design also determined whether significant differences existed in performances of the tests when the subjects performed with both eyes, with the dominant eye only, and with the non-dominant eye only. Interaction between the lateral dominance of the subjects and the eye(s) used in performing was also tested for significance. This statistical procedure was repeated for each of the three tests of throwing accuracy.

Orthogonal comparisons were used to determine the nature of the significant differences indicated by the analysis of variance.

ANALYSIS OF DATA ON THREE TESTS OF HAND DOMINANCE AND THREE TESTS OF EYE DOMINANCE

Three tests of hand dominance and three tests of eye dominance were administered to 182 eighth grade subjects. A large majority of the subjects (sixty-five percent), as shown in Table I, showed consistent right handed responses on all three tests of hand dominance. These subjects were considered pure right handed. Only seventeen percent were pure left handed, or showed consistent left handed responses on the three tests of hand dominance. Twelve percent showed mixed or inconsistent responses.

A smaller majority of subjects (fifty-two percent), showed pure right eyed responses as compared to pure right handedness. More subjects indicated pure left eyedness however (thirty-three percent), than pure left handedness. Fifteen percent showed mixed responses.

TABLE I

HAND AND EYE DOMINANCE OF 182 EIGHTH GRADE MALE SUBJECTS

	Pure Right	Pure Left	Mixed	Total
Hand Dominance	120(65%)	32(17%)	30(12%)	182
Eye Dominance	95(52%)	60(33%)	27(15%)	182

Results of the dominance tests indicated that forty-six percent of the subjects tested were defined as unilaterally dominant (See Table II). Twenty-two percent were defined as crossed dominant and thirty-two percent were mixed dominant. Of the eighty-five subjects who were unilaterally dominant, seventy-six were right handed and right eyed and only nine were left handed and left eyed. Of the forty crossed dominant subjects all but one were right handed and left eyed.

Analysis of the data indicated that 125 of the subjects tested (sixty-eight percent), qualified to participate further in the tests of throwing accuracy. Of this group, sixty-eight percent were unilaterally dominant and thirty-two percent crossed dominant.

TABLE II

PROPORTION OF CROSSED DOMINANT AND UNILATERALLY DOMINANT SUBJECTS RESULTING FROM SIX TESTS OF EYE AND HAND DOMINANCE

	R.Handed R. Eyed	L.Handed L.Eyed	R.Handed L.Eyed	L.Handed R.Eyed	Total
Crossed Dominant	-	-	39	1	40(22%)
Unilaterally Dominant	76	9	-	-	85(46%)
Mixed Dominant	-	-	-	-	57(32%)

The fifty-seven subjects defined as mixed dominant were eliminated from participation in the study because of inconsistent results on the tests of hand or eye dominance. Results, as indicated in Table III, show that thirty subjects were eliminated on the tests of hand dominance and twenty-seven on the tests of eye dominance.

Further investigation revealed that eye dominance test number one, the telescope test, eliminated seventy percent of the subjects who exhibited inconsistency on the tests of eye dominance. Eye dominance tests numbers two and three, the blackboard and cardboard tests, were about equal in the number of subjects eliminated.

Test number one, the needle and thread, and test number two, swinging the bat, eliminated ninety percent of all the subjects who showed inconsistency on the tests of hand dominance. Only three subjects were eliminated because of test number three, throwing the ball.

With 182 subjects tested, the battery of three eye dominance tests revealed a dominant eye in 155 (eighty-five percent). The hand dominance tests revealed a dominant hand in 152 (eighty-three percent).

TABLE III

MIXED DOMINANT SUBJECTS ELIMINATED FROM THE STUDY RESULTING FROM SIX TESTS OF EYE AND HAND DOMINANCE

	Eye Dominance	Hand Dominance
Telescope Test	19	-
Blackboard Test	5	-
Cardboard Test	3	-
Needle and Thread Test	-	14
Bat Test	-	13
Ball Test	-	3
Total	27	30 = 57

ANALYSIS OF SCORES OF UNILATERALLY DOMINANT AND CROSSED DOMINANT SUBJECTS ON THROWING ACCURACY PERFORMED IN TEST I

Analysis of Variance

In the analysis of variance of scores of unilaterally dominant and crossed dominant eighth grade male subjects on throwing accuracy performed on Test I, the baseball pitching test, the variance for Level A in Table IV resulted in an F-ratio of 1.79, which was non-significant. This indicated that there was no significant difference between the mean

of 16.70 for the unilaterally dominant subjects and the mean of 15.58 for the crossed dominant subjects.

The F-ratio for Level B was found to be 9.05, which was significant at the .01 level of probability. This indicated that there were significant differences in throwing accuracy performed in Test I between the three conditions of throwing: (1) with both eyes, (2) with the dominant eye only, and (3) with the non-dominant eye only.

The interaction for Levels A and B showed an F-ratio of 1.32. The F-ratio was non-significant, which indicated that the relative differences between unilaterally dominant and crossed dominant subjects remained uniform for the three conditions under which the subjects performed.

Orthogonal Comparisons

As a result of the significant F-ratio obtained for Level B (test conditions), orthogonal comparisons were computed to locate the nature of the differences. There were two comparisons permissible among the three conditions (C-1). The following pattern was used for comparisons:

Comparisons	Both Eyes	Dominant Eye	Non-Dominant Eye
C1	0	1	-1
C2	2	-1	-1

In the first comparison, throwing while using the dominant eye was compared with throwing while using the non-

TABLE IV

ANALYSIS OF VARIANCE AND ORTHOGONAL COMPARISONS OF SCORES OF FORTY UNILATERALLY DOMINANT AND FORTY CROSSED DOMINANT EIGHTH GRADE MALE SUBJECTS ON THROWING ACCURACY PERFORMED IN TEST I

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F	P
A (Dominance)	71.50	1	71.50	1.79	NS
Between Error	3,109.24	78	39.86		
B (Conditions)	144.38	2	72.19	9.05	.01
AxB (Interaction)	21.14	2	10.57	1.32	NS
Within Error	1,243.98	156	7.98		
Total	4,590.24	239			
C1 (Dom.vs.N.Dom.)	1.16	1	1.16	0.14	NS
C2 (Both Eyes vs. Dom.,N.Dom.)	142.91	1	142.91	17.91	.01
Total	144.07	2			

F needed for significance:
1 and 78 df, .05 level=3.96 2 and 156 df, .05 level=3.06
.01 level=6.97 .01 level=4.75
1 and 156 df, .05 level=3.90
.01 level=6.81

Group	Mean Score Test I	SD
Crossed Dominant	15.58	4.36
Unilaterally Dominant	16.70	4.33
Two Eyes	17.23	4.51
Dominant Eye only	15.51	4.18
Non-Dominant Eye only	15.68	4.35

dominant eye. The results are shown in Table IV. This comparison yielded a sum of squares of 1.16 and an F-ratio of 0.14, which was non-significant. This indicated that there was no significant difference between scores made when subjects threw for accuracy while using the dominant eye and when using the non-dominant eye.

In the second comparison, throwing while using both eyes was compared to throwing while using the dominant and non-dominant eye. This comparison yielded an F-ratio of 17.91, which was significant at the .01 level of probability. This indicated that throwing accuracy in Test I, while using both eyes (mean, 17.23) was superior to the combined mean scores made under the other conditions (dominant eye, mean 15.51 and non-dominant eye, mean 15.68).

ANALYSIS OF SCORES OF UNILATERALLY DOMINANT AND CROSSED DOMINANT SUBJECTS ON THROWING ACCURACY PERFORMED IN TEST II

Analysis of Variance

In the analysis of variance of scores of unilaterally dominant and crossed dominant eighth grade male subjects performed in Test II, the results of Level A revealed an F-ratio of 0.86 (See Table V). The F-ratio being non-significant, indicated that there were no significant differences

between the scores of unilaterally dominant subjects (mean score, 15.04), and the scores of crossed dominant subjects (mean, 14.49) in throwing accuracy in the basketball shooting test.

The F-ratio for Level B was found to be 7.30, which was significant at the .01 level of probability. This indicated that there were significant differences in throwing accuracy in Test II between the three conditions of throwing: (1) with both eyes, (2) with the dominant eye only, and (3) with the non-dominant eye only. The interaction of Levels A and B was non-significant.

Orthogonal Comparisons

As a result of the significant F-ratio obtained for Level B, orthogonal comparisons were computed to locate the nature of the differences.

In the first comparison, throwing while using the dominant eye was compared with throwing while using the non-dominant eye. The results are shown in Table V. This comparison yielded an F-ratio of 0.02, which was non-significant.

In the second comparison, throwing while using both eyes was compared to throwing while using the dominant and non-dominant eye. This comparison yielded an F-ratio of

TABLE V

ANALYSIS OF VARIANCE AND ORTHOGONAL COMPARISONS OF SCORES OF FORTY UNILATERALLY DOMINANT AND FORTY CROSSED DOMINANT EIGHTH GRADE MALE SUBJECTS ON THROWING ACCURACY PERFORMED IN TEST II

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F	P
A (Dominance)	17.88	1	17.88	0.86	NS
Between Error	1,620.70	78	20.78		
B (Conditions)	130.92	2	65.46	7.30	.01
AxB (Interaction)	32.51	2	16.26	1.81	NS
Within Error	1,400.88	156	8.98		
Total	3,202.89	239			
C1 (Dom.vs.N.Dom.)	0.17	1	0.17	0.02	NS
C2 (Both Eyes vs. Dom.,N.Dom.)	131.21	1	131.21	14.61	.01
Total	131.38	2			

F needed for significance:
1 and 78 df, .05 level=3.96; .01 level=6.97
1 and 156 df, .05 level=3.90; .01 level=6.81
2 and 156 df, .05 level=3.06; .01 level=4.75

Group	Mean Score Test II	SD
Crossed Dominant	14.49	3.77
Unilaterally Dominant	15.04	3.38
Two eyes	15.82	3.58
Dominant eye only	14.22	3.22
Non-Dominant eye only	14.28	3.92

14.61, which was significant at the .01 level of probability. This indicated that throwing accuracy in Test II with both eyes, (mean of 15.82) was superior to throwing with only the dominant eye, (mean of 14.22) or with only the non-dominant eye. (mean of 14.28).

ANALYSIS OF SCORES OF UNILATERALLY DOMINANT AND CROSSED DOMINANT SUBJECTS ON THROWING ACCURACY PERFORMED IN TEST III

Analysis of Variance

As seen in Table VI, the comparison of scores for unilaterally dominant and crossed dominant eighth grade male subjects in Test III, the repeated throwing test, resulted in an F-ratio of 5.26 which was significant at .05 level of probability. This indicated that there was a significant difference between the mean of 6.98 for the unilaterally dominant subjects and the mean of 5.74 for the crossed dominant subjects in throwing accuracy.

The F-ratio for Level B was found to be 26.18, which was significant at the .01 level of probability. This indicated that there were significant differences in throwing accuracy under the three conditions.

The F-ratio for the interaction of Levels A and B was not significant at the .05 level of probability.

Orthogonal Comparisons

Because of the significant F-ratio for Level B (conditions), orthogonal comparisons were computed.

In the first comparison, throwing while using the

TABLE VI

ANALYSIS OF VARIANCE AND ORTHOGONAL COMPARISONS OF SCORES OF FORTY UNILATERALLY DOMINANT AND FORTY CROSSED DOMINANT EIGHTH GRADE MALE SUBJECTS ON THROWING ACCURACY PERFORMED IN TEST III

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F	P
A (Dominance)	49.05	1	49.05	5.26	.05
Between Error	727.90	78	9.33		
B (Conditions)	163.34	2	81.67	26.18	.01
AxB (Interaction)	3.60	2	1.80	0.58	NS
Within Error	486.77	156	3.12		
Total	1,430.66	239			
C1 (Dom.vs.N.Dom.)	4.03	1	4.03	1.29	NS
C2 (Both Eyes vs. Dom.,N.Dom.)	159.85	1	159.85	51.23	.01
Total	163.88	2			

F needed for significance:
1 and 78 df, .05 level=3.96 .01 level=6.97
1 and 156 df, .05 level=3.90 .01 level=6.81
2 and 156 df, .05 level=3.06 .01 level=4.75

Group	Mean Score Test III	SD
Crossed Dominant	5.74	2.32
Unilaterally Dominant	6.98	2.49
Two eyes	7.18	2.58
Dominant eye only	5.79	2.14
Non-Dominant eye only	6.10	2.09

dominant eye was compared with throwing while using the non-dominant eye. Results are shown in Table VI. This comparison yielded an F-ratio of 1.29, which indicated that there were no significant differences between the mean throwing scores while using the dominant eye, and while using the non-dominant eye on Test III.

In the second comparison, throwing while using both eyes was compared to the combined scores for the dominant and non-dominant eye. This comparison yielded an F-ratio of 51.23 which was significant at the .01 level of probability in favor of the conditions in which the subjects threw while using both eyes. The mean for this group was 7.18. The mean for the dominant eye condition was 5.79, and the mean for the non-dominant eye condition was 6.10.

CHAPTER V

SUMMARY, FINDINGS, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

The purpose of this study was to investigate the hypothesis that individuals exhibiting unilateral dominance perform better in tests of throwing accuracy than crossed dominant individuals. Eighty eighth grade male students were selected from Istrouma Junior High School, Baton Rouge, Louisiana, and Sheridan Junior High School, New Haven, Connecticut as subjects. The subjects were selected based upon the results of three tests of eye dominance, and three tests of hand dominance, administered to a total of 182 students. Forty subjects who exhibited eye and hand dominance on the same side of the body were defined as unilaterally dominant, and forty subjects who exhibited eye and hand dominance on the opposite side were classified as crossed dominant. These eighty subjects performed three tests of throwing accuracy.

The three tests of throwing accuracy were administered to the subjects twice, with the average score being recorded as the representative score. All three tests were similar

due to the fact that they involved throwing a ball at a stationary target. The tests differed, however, in the various types of balls used, the distances thrown, the trajectory employed in the throw, the time allowed to aim, and the starting position.

A secondary purpose of the study was to investigate the results of throwing accuracy performed with both eyes open as compared to the use of only the dominant eye, or only the non-dominant eye. All subjects performed the three tests of throwing accuracy under the three different conditions. A black eye patch was worn over the eye not being tested while the subjects were tested with either the dominant or non-dominant eye. Altogether, each subject received three tests, under three conditions twice, totalling eighteen individual tests in all. A counter balanced practice order was employed.

The tests were scored and data processed at the Computer Center of Southern Connecticut State College, New Haven, Connecticut. Mean scores were computed for the two groups, unilateral and crossed dominant, and also for the three conditions, both eyes, dominant eye, and non-dominant eye. Analysis of variance, utilizing a two factor analysis with repeated measures on the same subjects was computed for the scores to determine whether significant differences existed between the unilaterally dominant individuals and the crossed dominant individuals in tests of throwing accuracy. This

statistical design also determined if significant differences existed in performances of the tests when the subjects performed with both eyes, with the dominant eye only, and with the non-dominant eye only. The interaction between the lateral dominance of the subjects and the eye(s) used while performing was also tested for significance. This statistical procedure was repeated for each of the three tests of throwing accuracy. Orthogonal comparisons were employed to determine the nature of the significant differences among the three throwing conditions for each test.

FINDINGS

The findings of this study were:

1. There were no significant differences between the unilaterally dominant subjects and the crossed dominant subjects on Test I, the baseball pitching test, and Test II, the basketball shooting test.

2. Unilaterally dominant subjects significantly outperformed the crossed dominant subjects on Test III, the repeated throwing test.

3. Performances in throwing accuracy were significantly superior while using both eyes than when performing with either the dominant or non-dominant eye on all three tests of throwing accuracy.

4. There were no significant differences between performances while using the dominant eye only, and while using the non-dominant eye only on any of the three tests of throwing accuracy.

5. There was no significant interaction between the lateral dominance of the subjects and the eye(s) used in performing on any of the three tests of throwing accuracy.

DISCUSSION

If crossed dominant individuals are at a disadvantage in certain motor acts such as throwing accuracy, the investigator was of the opinion that apparently over a period of time these individuals probably compensate for this. A crossed dominant individual in learning a motor skill such as throwing accuracy, through trial and error, over a period of time probably overcomes any initial awkwardness or indecision he may have.

It was found that there were no significant differences between the crossed dominant subjects and the unilaterally dominant subjects on two tests of throwing accuracy, Tests I and II. Test I related to pitching in baseball, and Test II to shooting in basketball. Considering the fact that the subjects were eighth grade boys, the subjects most likely had previous experience in throwing activities that were somewhat similar to the testing situation. This may account for the fact that significant differences were not found. Although it may be noted that the unilaterally dominant subjects did

have a higher mean score on both of the tests, even though the differences were not significant.

Unilaterally dominant subjects did significantly outperform the crossed dominant subjects on Test III. Test III did not relate as much to any particular sport or activity, and in comparison to the first two tests was more unique. The investigator theorized that the crossed dominant subjects lacked the previous experience on this test that they had on the first two and possibly were at a disadvantage due to initial awkwardness or indecision in their performance.

The results concur with the findings obtained in a study by Freeman and Chapman[1] who concluded that eye and hand dominance played an important role in the early stages of learning a motor skill, but lessened in importance as time continued. Results similar to those in Test III were also found in two studies by Robinson[2] and Adams.[3] These authors found that the unilaterally dominant individuals significantly outperformed the crossed dominant individuals in tests of

---

[1]G. L. Freeman and J.S. Chapman, "The Relative Importance of Eye and Hand Dominance In a Pursuit Skill," The American Journal of Psychology, 47:146-149, January, 1935.

[2]Edwin Nelson Robinson, "A Comparison of Laterally Dominant to Crossed Dominant Individuals in Tests of Reaction Time and Hand-Eye Coordination," Microcard, MA Thesis, University of California at Santa Barbara, 1965, p. 65.

[3]Gary L. Adams, "Effect of Eye Dominance on Baseball Batting," Research Quarterly, 36:3-9, March, 1965.

motor coordination and batting in baseball. In a third study, Horine[4] found no significant differences between the two groups, but did note that the unilaterals consistently outperformed the crossed dominants in tests of motor ability.

It would seem that a similar study involving subjects of a younger age group would be of value. Young boys about the ages of six or seven are just beginning to develop skills such as throwing accuracy. It would be interesting to investigate any possible differences in crossed dominant and unilaterally dominant individuals in throwing accuracy. It would enable the investigator to explore the importance of eye and hand dominance in the early stages of learning, and determine whether crossed dominant individuals do have a more difficult time in developing throwing accuracy than unilaterally dominant individuals at this age level.

Test III, in comparison to Tests I and II, was also a more complex skill in that it involved catching the ball prior to throwing at a target. This variable may have appreciably influenced the results in which it was seen that the unilaterals outperformed the crossed dominants on this particular test.

The literature also supports the finding that performances in throwing accuracy were significantly superior while

---

[4]Lawrence Horine, "An Investigation of the Relationship of Laterality Groups to Performance on Selected Motor Ability Tests," Research Quarterly, 39:90-95, March, 1968.

using both eyes than when performing with the dominant or non-dominant. Lund[5] in using simple target test and Baughman[6] in exploring batting in baseball found similar results. Lund[7] also found that the scores for the dominant eye were significantly greater than for the non-dominant eye. These results were not confirmed by this study in which no significant differences were found between performing while using the dominant eye only and while using the non-dominant eye only.

CONCLUSIONS

Within the limitations of this study, the following conclusions appeared to be justified:

1. There appears to be some justification to the hypothesis that unilaterally dominant individuals outperform crossed dominant individuals in throwing accuracy, particularly in throwing tasks of greater complexity.

2. Performing while using both eyes is superior to performing with either the dominant eye only or non-dominant eye only in throwing for accuracy.

---

[5]F. H. Lund, "The Dependence of Eye-Hand Coordination Upon Eye Dominance," American Journal of Psychology, 44:756-762, December, 1932.

[6]Larry Baughman, "Two Methods of Determining the Effects of Sighting Dominance on Baseball Hitting," MA Thesis, University of Maryland, 1968, College Park, cited in Completed Research in Health, Physical Education, and Recreation, Vol.:11 ed. Robert N. Singer and Raymound A. Weiss (Washington. American Association for Health, Physical Education, and Recreation, 1969), p. 132.

[7]Lund, loc. cit.

RECOMMENDATIONS

1. A study should be conducted to compare crossed dominant to unilaterally dominant individuals in tests of throwing accuracy, employing children six or seven years of age as subjects.

2. A study should be conducted to compare crossed dominant to unilaterally dominant individuals in various motor activities involving different degrees of complexity.

3. A study should be conducted investigating the relationship of eye dominance with other visual characteristics such as visual acuity, depth vision, peripheral vision, etc., and their combined influence upon throwing accuracy.

SELECTED BIBLIOGRAPHY

SELECTED BIBLIOGRAPHY

A. BOOKS

Clark, Margaret M. Teaching Left Handed Children. New York: Philosophical Library Inc., 1961.

Cratty, Bryant J. Movement Behavior and Motor Learning. Philadelphia: Lea and Febiger, 1968.

_____. Perceptual Motor Behavior and Educational Processes. Springfield, Illinois: Charles C. Thomas, 1969.

Delacato, Carl H. The Diagnosis and Treatment of Speech and Reading Problems. Springfield, Illinois: Charles C. Thomas, 1963.

Hécaen, Henry. Left Handedness, Manual Superiority and Cerebral Dominance. New York: Grune and Stratton, 1964.

Oxendine, Joseph. Psychology of Motor Learning. New York: Appleton-Century-Crofts, 1968.

Whiting, H. T. A. Acquiring Ball Skill. London: G. Bell and Sons, 1969.

B. PERIODICALS AND PUBLICATIONS

Adams, Gary L. "Effect of Eye Dominance on Baseball Batting," Research Quarterly, 36:3-9, March, 1965.

Banister, Henry. "A Study in Eye Dominance," The British Journal of Psychology, 27:34-42, January, 1935.

Baughman, Larry. "Two Methods of Determining the Effects of Sighting Dominance on Baseball Hitting," MA Thesis, University of Maryland, 1968, College Park, cited in Completed Research in Health, Physical Education, and Recreation, 11:132, 1969.

Belmont, Lillian, and Birch, Herbert Y. "Lateral Dominance and Right-Left Awareness in Normal Children," Child Development, 34:257-270, June, 1963.

Benton, Arthur, and Menefree, Frances L. "Handedness and Right Left Discrimination," Child Development, 28:237-242, June, 1957.

Cornell, Constance. "Eye, Hand, and Foot Preferences of Psychotic Patients Compared with College Students," The Journal of Juvenile Research, 22:115-118, April, 1938.

Dart, Carroll. "Eye, Hand, and Foot Preference of Mentally Subnormal Subjects Compared with Individuals of Normal or Superior Intelligence," The Journal of Juvenile Research, 22:119-121, April, 1938.

Durost, Walter N. "The Development of a Battery of Objective Group Tests of Manual Laterality, with the Results of their Application to 1300 Children," Genetic Psychology Monographs, 26:232, October 1934.

Eyre, Mary B. "Studies in Eye, Hand, and Foot Preferences," The Journal of Juvenile Research, 22:109-114, April,1938.

Fink, Walter H. "The Dominant Eye,: Archives of Ophthalmology, 19:555-582, April,1938.

Fox, Margaret. "Lateral Dominance in the Teaching of Bowling," Research Quarterly, 28:327-331, December, 1957.

Freeman, G. L., and Chapman, J. S. "The Relative Importance of Eye and Hand Dominance in a Pursuit Skill," The American Journal of Psychology, 47:146-149, January, 1935.

Gessell, Arnold, and Ames, Louise. "The Development of Handedness,: Journal of Genetic Psychology, 70:155-175, February, 1947.

Hildreth, Gertrude. "The Development and Training of Hand Dominance," Journal of Genetic Psychology, 75:255-275, November, 1949.

Horine, Lawrence. "An Investigation of the Relationship of Laterality Groups to Performance on Selected Motor Ability Tests," Research Quarterly, 39:90-95, March,1968.

Irwin, Leslie. "A Study of the Relationship of Dominance to The Performance of Physical Education Activities," Research Quarterly, 9:98-119, May, 1938.

Lund, F. H. "The Dependence of Eye-Hand Coordination Upon Eye Dominance," American Journal of Psychology, 44:756-762, December, 1932.

Mills, Lloyd. "Unilateral Sighting," California and Western Medicine, 28:191, January, 1928.

Ojemann, R. H. "Studies in Handedness," The Journal of Educational Psychology, 21:597-611, November, 1930.

Provins, K. A. "Handedness and Skill," The Quarterly Journal of Experimental Psychology, 8:79-95, February, 1956.

Sinclair, Caroline B., and Smith, Inez M. "Laterality in Swimming and its Relationship to Dominance of Hand, Eye, and Foot," Research Quarterly, 28:395-402, December, 1957.

Smith, Leon E., and Lewis, Floyd D. "Handedness and its Influence upon Static Neuromuscular Control," Research Quarterly, 34:206-212, May, 1963.

Trembley, Dean. "Crossed Dominance of Hand and Eye in Relation to Poliomyelitis," Perceptual Motor Skills, 26:231-234, February, 1968.

Turner, Edith. "Eye, Hand, and Foot Preferences of Emotionally Unstable Adolescents Compared With Stable Adolescents," The Journal of Juvenile Research, 22:122-124, April, 1938.

Vogel, O. H. "The Relationship of Dominance to Acts of Skill," Research Quarterly, 6:15-18, October, 1935.

Way, Eunice. "Relationships of Lateral Dominance to Scores of Motor Ability and Selected Skill Tests," Research Quarterly, 29:360-369, October, 1958.

Zagora, E. "Observations on the Evolution and Neurophyiology of Eye-Limb Coordination," Ophthalmology, 138:241-254, April, 1959.

C. UNPUBLISHED MATERIALS

Robinson, Edwin Nelson. "A Comparison of Laterally Dominant to Crossed Dominant Individuals in Tests of Reaction Time and Hand-Eye Coordination," Microcard, MA Thesis, University of California at Santa Barbara, Santa Barbara, 1965.

APPENDIXES

APPENDIX A

RAW SCORES FROM TESTS OF EYE AND HAND DOMINANCE

Eye Dominance

T-1 = Telescope test
T-2 = Blackboard test
T-3 = Cardboard test

Hand Dominance

T-1 = Needle and Thread test
T-2 = Bat test
T-3 = Ball test

R = Right
L = Left
M = Mixed

C = Crossed Dominance
U = Unilateral Dominance
E = Eliminated

Subject	Eye Tests T-1	T-2	T-3	Eye Dom.	Hand Tests T-1	T-2	T-3	Hand Dom.	Lateral Dom.
1	L	R	R	M	R	R	R	R	E
2	R	L	L	M	R	R	R	R	E
3	L	L	L	L	L	L	L	L	U
4	L	R	R	M	R	R	R	R	E
5	R	R	R	R	R	R	R	R	U
6	R	R	R	R	R	R	R	R	U
7	R	R	R	R	R	R	R	R	U
8	R	R	R	R	R	R	R	R	U
9	L	L	L	L	L	L	L	L	U
10	R	L	L	M	R	R	R	R	E
11	R	R	R	R	R	R	R	R	U
12	R	R	R	R	R	R	R	R	U
13	R	R	R	R	R	R	R	R	U
14	R	R	R	R	L	R	R	M	E
15	L	L	L	L	R	R	R	R	C
16	L	L	R	M	R	R	R	R	E
17	R	L	L	M	R	R	R	R	E
18	R	L	L	M	L	R	R	M	E
19	L	L	L	L	R	R	R	R	C
20	R	R	R	R	R	R	L	M	E

Subject	Eye Tests T-1	T-2	T-3	Eye Dom.	Hand Tests T-1	T-2	T-3	Hand Dom.	Lateral Dom.
21	L	L	L	L	R	R	R	R	C
22	L	L	L	L	R	R	R	R	C
23	R	R	R	R	R	R	R	R	U
24	R	R	R	R	R	R	R	R	U
25	R	R	R	R	R	R	R	R	U
26	R	R	R	R	L	R	R	M	E
27	R	R	R	R	R	R	R	R	U
28	L	L	L	L	R	R	R	R	C
29	R	L	L	M	R	R	R	R	E
30	R	R	R	R	R	R	R	R	U
31	R	R	R	R	R	R	R	R	U
32	L	L	L	L	L	R	R	M	E
33	R	R	R	R	R	R	R	R	U
34	R	R	R	R	R	R	R	R	U
35	L	L	L	L	L	L	L	L	U
36	R	R	R	R	R	R	R	R	U
37	L	L	L	L	R	R	R	R	C
38	R	L	L	M	R	L	R	M	E
39	R	R	R	R	R	R	R	R	U
40	R	R	R	R	R	R	R	R	U
41	R	L	L	M	R	R	R	R	E
42	L	R	L	M	L	L	L	L	E
43	R	R	R	R	R	L	R	M	E
44	R	R	R	R	R	R	R	R	U
45	L	L	L	L	R	R	R	R	C
46	L	L	L	L	R	R	R	R	C
47	R	R	R	R	L	R	R	M	E
48	L	L	L	L	R	L	R	M	E
49	R	R	R	R	R	R	R	R	U
50	R	R	R	R	R	R	R	R	U
51	L	L	L	L	R	R	R	R	C
52	R	R	R	R	R	R	R	R	U
53	L	L	L	L	R	R	R	R	C
54	R	R	R	R	L	R	R	M	E
55	R	R	R	R	L	R	R	M	E
56	R	R	R	R	R	R	R	R	U
57	L	R	R	M	R	R	R	R	E
58	R	R	R	R	L	R	R	M	E
59	L	L	L	L	L	L	L	L	U
60	R	R	R	R	R	R	R	R	U

Subject	Eye Tests T-1	T-2	T-3	Eye Dom.	Hand Tests T-1	T-2	T-3	Hand Dom.	Lateral Dom.
61	L	L	L	L	L	R	L	M	E
62	L	L	L	L	L	R	L	M	E
63	R	R	L	M	R	R	R	R	M
64	R	R	R	R	R	R	R	R	U
65	R	R	R	R	R	R	R	R	U
66	L	R	R	M	R	R	R	R	E
67	R	L	R	M	R	R	R	R	E
68	L	L	L	L	R	R	R	R	C
69	L	L	L	L	L	R	R	M	E
70	L	L	L	L	L	R	R	M	E
71	L	L	L	L	L	R	R	M	E
72	R	R	R	R	L	R	R	M	E
73	R	R	R	R	R	L	R	M	E
74	R	R	R	R	L	R	R	M	E
75	L	L	L	L	L	R	L	M	E
76	R	L	L	M	R	R	R	R	E
77	R	L	L	M	R	R	R	R	E
78	L	L	L	L	R	R	R	R	C
79	R	R	R	R	R	R	R	R	U
80	R	R	R	R	R	R	R	R	U
81	R	R	R	R	R	R	R	R	U
82	R	R	R	R	R	R	R	R	U
83	L	R	R	M	R	R	R	R	E
84	R	R	R	R	R	R	R	R	U
85	L	L	L	L	R	R	R	R	C
86	R	L	R	M	R	R	R	R	E
87	R	R	R	R	R	R	R	R	U
88	R	R	R	R	L	R	R	M	E
89	R	R	R	R	R	R	R	R	U
90	L	L	L	L	R	R	R	R	C
91	R	R	R	R	R	R	R	R	U
92	R	R	R	R	R	R	R	R	U
93	R	L	L	M	R	R	R	R	E
94	L	L	L	L	L	R	L	M	E
95	R	R	R	R	R	R	R	R	U
96	R	R	R	R	R	R	R	R	U
97	L	R	R	M	R	R	R	R	E
98	L	L	L	L	L	L	R	M	E
99	L	L	L	L	L	R	L	M	E
100	R	R	L	M	R	R	R	R	E

Subject	Eye Tests T-1	T-2	T-3	Eye Dom.	Hand Tests T-1	T-2	T-3	Hand Dom.	Lateral Dom.
101	L	L	L	L	R	R	R	R	C
102	R	R	R	R	R	R	R	R	U
103	R	R	R	R	R	R	R	R	U
104	L	L	L	L	R	R	R	R	C
105	R	R	R	R	R	R	R	R	U
106	R	R	R	R	R	R	R	R	U
107	R	R	R	R	R	R	R	R	U
108	L	R	L	M	R	R	R	R	M
109	L	L	L	L	R	R	R	R	C
110	R	R	R	R	R	R	R	R	U
111	R	R	R	R	R	R	R	R	U
112	R	R	R	R	R	R	R	R	U
113	L	L	L	L	R	R	R	R	C
114	L	R	R	M	R	R	R	R	E
115	L	R	R	M	R	R	R	R	E
116	L	L	L	L	L	R	L	M	E
117	L	R	R	M	R	R	R	R	E
118	R	R	R	R	R	R	R	R	U
119	R	R	R	R	R	R	R	R	U
120	L	L	L	L	R	R	R	R	C
121	R	R	R	R	R	R	R	R	U
122	L	L	L	L	R	R	R	R	C
123	R	R	R	R	R	R	R	R	U
124	R	R	R	R	R	R	R	R	U
125	L	L	L	L	L	L	L	L	U
126	R	R	R	R	R	R	R	R	U
127	R	R	R	R	R	R	R	R	U
128	R	R	R	R	R	R	R	R	U
129	L	L	L	L	R	R	R	R	C
130	R	R	R	R	R	R	R	R	U
131	L	L	L	L	R	R	R	R	C
132	R	R	R	R	L	L	L	L	C
133	L	L	L	L	R	R	R	R	C
134	R	R	R	R	R	L	R	M	E
135	L	L	L	L	R	R	R	R	C
136	R	R	R	R	R	R	R	R	U
137	R	R	R	R	R	R	R	R	U
138	R	R	R	R	R	R	R	R	U
139	L	L	L	L	L	R	L	M	E
140	L	L	L	L	R	R	R	R	C

Subject	Eye Tests T-1	T-2	T-3	Eye Dom.	Hand Tests T-1	T-2	T-3	Hand Dom.	Lateral Dom.
141	L	L	L	L	R	R	R	R	C
142	L	L	L	L	L	R	L	M	E
143	L	L	L	L	R	R	R	R	C
144	R	R	R	R	R	R	R	R	U
145	L	L	L	L	R	R	R	R	C
146	R	R	R	R	R	R	R	R	U
147	L	L	L	L	R	R	R	R	C
148	R	R	R	R	R	R	R	R	U
149	R	R	R	R	L	L	L	L	C
150	L	R	L	M	R	R	R	R	R
151	R	R	R	R	L	L	R	M	E
152	R	R	R	R	R	R	R	R	U
153	R	R	R	R	R	R	R	R	U
154	R	R	R	R	R	R	R	R	U
155	L	L	L	L	L	L	L	L	U
156	R	R	R	R	R	R	R	R	U
157	L	L	L	L	R	R	R	R	C
158	R	R	R	R	R	R	R	R	U
159	L	L	L	L	R	R	R	R	C
160	L	L	L	L	R	R	R	R	C
161	L	R	R	M	R	R	R	R	M
162	R	R	R	R	R	R	R	R	U
163	R	R	R	R	R	R	R	R	U
164	R	R	R	R	R	L	R	M	E
165	R	R	R	R	R	R	R	R	U
166	L	L	L	L	R	R	R	R	C
167	R	R	R	R	R	R	R	R	U
168	R	R	R	R	R	R	R	R	U
169	L	L	L	L	R	R	R	R	C
170	L	L	L	L	R	R	R	R	C
171	L	L	L	L	R	R	R	R	C
172	R	R	R	R	R	R	R	R	U
173	R	R	R	R	R	R	R	R	U
174	R	R	R	R	R	R	R	R	U
175	R	R	R	R	R	R	R	R	U
176	R	R	R	R	R	L	R	M	E
177	R	R	R	R	R	R	R	R	U
178	L	L	L	L	L	L	L	L	U
179	L	L	L	L	L	L	L	L	U
180	R	R	R	R	R	R	R	R	U
181	L	L	L	L	R	R	R	R	C
182	L	L	L	L	R	R	R	R	C

APPENDIX B

AVERAGE SCORES FROM TESTS OF THROWING ACCURACY

Test I - Baseball Pitching Test

Subject	Dominance	Both Eyes	Dominant Eye	Non-Dominant Eye
1	U	15	12	15
2	U	12	12.5	16
3	U	14.5	16	15.5
4	U	8.5	13	14.5
5	U	22.5	19	23
6	U	21	19	17
7	U	11.5	13.5	17.5
8	U	15.5	16	22
9	C	21.5	15.5	17.5
10	C	20.5	19	18.5
11	C	20	19.5	20
12	C	16.5	18.5	13.5
13	U	17.5	23.5	18
14	C	23.5	24	20
15	U	8.5	8	6.5
16	U	14	19	17
17	U	22	20.5	22.5
18	U	12.5	22	13.5
19	U	19	12	17.5
20	C	23	21	23
21	C	8	12	11
22	U	15.5	16.5	16.5
23	C	15	14	19.5
24	C	22.5	17.5	18.5
25	U	25.5	21.5	22.5
26	C	13	13	12
27	U	22	16	15
28	C	14	7	9.5
29	U	14.5	16	15
30	U	18	12.5	16
31	U	18	16	20.5
32	U	22.5	18	22.5
33	U	24	17.5	19.5
34	U	22	19	18
35	C	19.5	13.5	13.5

Subject	Dominance	Both Eyes	Dominant Eye	Non-Dominant Eye
36	U	23	20.5	21
37	U	17.5	14	15
38	U	19	18.5	17
39	C	16	13	15.5
40	U	20.5	14	16.5
41	C	11.5	11	13
42	C	14	9.5	16.5
43	U	16	14	13.5
44	C	19.5	14	21
45	U	20	16.5	16.5
46	U	17.5	17.5	19
47	C	19	25	23
48	U	26.5	22	19
49	U	17.5	22	22
50	U	19	13.5	17.5
51	C	15	11.5	11
52	U	17.5	13	9.5
53	C	20	19.5	18
54	C	14	12	9.5
55	U	12	16	11
56	U	20	16	12
57	U	10.5	18	4.5
58	C	18	16	21
59	C	19.5	8.5	14
60	C	10	5.5	6.5
61	C	17	11	11.5
62	C	21	13	18
63	C	17	15	16
64	C	16.5	10.5	13
65	C	14	12	11.5
66	C	13	11	11
67	C	16.5	12	7.5
68	U	19	16.5	10
69	U	21	15	11
70	C	11	9	15.5
71	C	17	10	14.5
72	C	15	18	14
73	C	11.5	7.5	10
74	C	17.5	13.5	15.5
75	C	19	15.5	15.5

Subject	Dominance	Both Eyes	Dominant Eye	Non-Dominant Eye
76	C	24	26	17.5
77	C	24	19.5	22
78	C	12	13.5	18
79	C	13.5	21	13.5
80	C	14.5	16.5	8.5

Test II - Basketball Shooting Test

Subject	Dominance	Both Eyes	Dominant Eye	Non-Dominant Eye
1	U	14	9	13
2	U	15	18.5	15
3	U	8.5	17	14
4	U	12	12	15.5
5	U	16.5	14.5	16.5
6	U	20	15	20
7	U	15	16.5	18.5
8	U	17.5	15	13
9	C	15	8	10.5
10	C	15.5	14.5	17
11	C	18	13	14
12	C	20	17	13.5
13	U	16.5	20	17
14	C	18	16.5	15
15	U	11.5	16	11
16	U	15	15	18
17	U	13	15.5	15
18	U	15	15	16.5
19	U	15	17.5	19
20	C	15	17	20.5
21	U	15	13	14
22	U	20	19.5	20.5
23	C	17	14.5	13.5
24	C	16	18	17.5
25	U	20	15	20.5
26	C	10	9	8
27	U	18.5	7	15.5
28	C	16	13.5	14.5
29	U	15	14	20
30	U	11.5	14	12

Subject	Dominance	Both Eyes	Dominant Eye	Non-Dominant Eye
31	U	21.5	15	17
32	U	20.5	17	13
33	U	21.5	15.5	16.5
34	U	15.5	13	13
35	C	16	17.5	19.5
36	U	16	12.5	16
37	U	13.5	14.5	13
38	U	15.5	12.5	14
39	C	13	16	20
40	U	20.5	17	14.5
41	C	12	12	8.5
42	C	12	14	14
43	U	13.5	17	15
44	C	19	10.5	18
45	U	18	20	13.5
46	U	17.5	15	16
47	C	20	8.5	19
48	U	18	17	9.5
49	U	20	19	17
50	U	10.5	15.5	10.5
51	C	20	15.5	17
52	U	17	14	11.5
53	C	17.5	9	16
54	C	12.5	12	16
55	U	12	15	12
56	U	18	15.5	10
57	U	15.5	12	9.5
58	C	13.5	11	9.5
59	C	16.5	10.5	14
60	C	15	12	7.5
61	C	16	8.5	12
62	C	20.5	20	10.5
63	C	24	14	21
64	C	15	7	19
65	C	10.5	9.5	9
66	C	23	11.5	15
67	C	17	19	17
68	U	4.5	7	4
69	U	14	16	8.5
70	C	11	13	7.5

Subject	Dominance	Both Eyes	Dominant Eye	Non-Dominant Eye
71	C	22	11.5	7.5
72	C	14	17.5	13
73	C	15	10.5	10
74	C	9.5	16	17.5
75	C	14	13.5	16.5
76	C	19.5	18	18
77	C	13	18	8
78	C	12	16	20
79	C	17.5	16	10.5
80	C	14.5	9	8.5

Test III - Repeated Throwing Test

Subject	Dominance	Both Eyes	Dominant Eye	Non-Dominant Eye
1	U	9.5	6.5	7.5
2	U	5.5	5.5	5.5
3	U	6	4	6
4	U	5	5.5	4
5	U	6	5.5	9.5
6	U	9	4	6
7	U	3.5	3.5	5
8	U	4	6.5	5
9	C	4	4	3.5
10	C	3.5	4	4.5
11	C	11	7	6.5
12	C	5	4.5	9.5
13	U	8	9	9.5
14	C	10.5	9.5	8.5
15	U	4.5	2.5	4.5
16	U	5.5	5.5	7
17	U	10.5	12	8
18	U	11.5	5	9
19	U	8.5	8	4.5
20	C	8.5	11	8
21	U	6.5	2.5	3.5
22	U	10.5	8	7.5
23	C	5	6	4
24	C	8.5	8	6.5
25	U	12.5	8.5	9.5

Subject	Dominance	Both Eyes	Dominant Eye	Non-Dominant Eye
26	C	8	5	8
27	U	11.5	7.5	4.5
28	C	6.5	3.5	5
29	U	8.5	7	8
30	U	6.5	6.5	3.5
31	U	7	5.5	9
32	U	9	8.5	10.5
33	U	9.5	6.5	10
34	U	8.5	5	5.5
35	C	7.5	5.5	5.5
36	U	9.5	5.5	8
37	U	12	5	7
38	U	12	5.5	6
39	C	7.5	8	6.5
40	U	11	10	7.5
41	C	5	6	3
42	C	4	5	4.5
43	U	4.5	4	7
44	C	11.5	2	2.5
45	U	11	3.5	7
46	U	8.5	6.5	7
47	C	8	8.5	10.5
48	U	6.5	5	5
49	U	10	11	9.5
50	U	6	4.5	3.5
51	C	7.5	6	4.5
52	U	12	8	7
53	C	5	4	5.5
54	C	7.5	5.5	6.5
55	U	3.5	4	4
56	U	8	4.5	3.5
57	U	6.5	5	4.5
58	C	5	7	4.5
59	C	10	3.5	9
60	C	6	4	4.5
61	C	7	4	5
62	C	10.5	7	9
63	C	9	2.5	8
64	C	6.5	4	4
65	C	6	3.5	4.5

Subject	Dominance	Both Eyes	Dominant Eye	Non-Dominant Eye
66	C	12	3.5	8
67	C	10.5	7	7
68	C	12	8	4.5
69	C	11	5	9
70	C	7.5	5	3.5
71	U	8	7.5	4.5
72	U	9.5	5	6
73	C	5.5	2	3
74	C	4	4.5	4.5
75	C	4	3	3
76	C	3.5	7.5	7.5
77	C	10	6.5	5
78	C	5	7.5	3.5
79	C	5.5	8	6
80	C	4	4	3

VITA

The author was born in Stratford, Connecticut on January 15, 1938. He received his elementary and high school education in Stratford.

In June,1961, the author received the Bachelor of Science degree at Southern Connecticut State College, New Haven, with a major in Health and Physical Education.

In August, 1962, the author received the Master of Science degree at the University of Bridgeport, Bridgeport, Connecticut, with a major in Education and a minor in Physical Education.

In the fall of 1962, the author was employed by the Danbury Connecticut school system as a physical education teacher at Danbury High School. The author remained at Danbury High School for a period of five years as a teacher of physical education, and head coach of basketball, and assistant coach in football and baseball.

In September of 1967, the author accepted the position of instructor of physical education and head coach of baseball at Western Connecticut State College, Danbury.

In September of 1968, the author entered the Louisiana State University Graduate School to begin work toward the

Doctor of Education degree with a major in Physical Education and a minor in Educational Administration. He served as a graduate assistant in the physical education department from the fall of 1968 to the summer of 1970.

EXAMINATION AND THESIS REPORT

Candidate: John Anthony Hajus

Major Field: Physical Education

Title of Thesis: A Comparison of Crossed Dominant to Unilaterally Dominant Individuals in Accuracy Motor Performance Tasks

Approved:

Jack K Nelson
Major Professor and Chairman

Max Goodrich
Dean of the Graduate School

EXAMINING COMMITTEE:

Mary L. Life

T. A. Drury

Helen E Faust

K. Gremillion

Date of Examination:

May 17, 1971